WINTECH
TESTING & CERTIFICATION

Technical Report

Report No: R19568 – Rev 1

UKAS TESTING
2223

Forterra Building Products Limited
Atherstone Road
Measham
Swadlincote
DE12 7EL

Project

Brick Slip Rainscreen System

CWCT Test Sequence

Project Ref: 19568

3rd June 2019

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R19568 - Rev 1 (Revised report) – this report has been amended as shown in Section 10 or Page 59 and it replaces previous report No. R19568 dated 20th May 2019

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Test Conducted at:	Above Address
Test Conducted for:	Forterra Building Products Limited
Standards Specified:	CWCT Test Methods for Building Envelopes – Dec 2005; Sections 5, 7, 9, 11, 12 & TN 76

The Test Sequence was Witnessed Wholly or in Part by:

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Project No:	19568
Dates of Final Test Sequence:	27th, 28th and 29th of March 2019
Product/System Tested:	Brick slip façade system
Tests Performed:	As Listed in Section 5 – Test Procedures

Final Test Sequence Conducted by:

R Cadwallader	Wintech Engineering Ltd
J Dove	Wintech Engineering Ltd
D Reynolds	Wintech Engineering Ltd

Report Compiled by: R Cadwallader, Test Engineer

Testing Supervised by: M Cox, Works Director

Technical Approval: (Authorising Signatory) D Price, Senior Test Engineer

Contents

1. INTRODUCTION

This report describes tests conducted at the test site of Wintech Engineering Ltd on a rainscreen system, on behalf of Forterra Building Products Limited.

The following test sequence was conducted on the 27th, 28th and 29th of March 2019 in order to determine the weather tightness of the sample with respect to air leakage, water penetration, wind and impact resistance. The test methods were in accordance with the following standards, and testing was conducted at the request of Forterra Building Products Limited.

CWCT Standard Test Methods for Building Envelopes - December 2005

Air Leakage (Infiltration & Exfiltration)	CWCT Section 5
Water Penetration – Dynamic Aero Engine	CWCT Section 7
Water Penetration – Hose	CWCT Section 9
Wind Resistance – Serviceability	CWCT Section 11
Wind Resistance – Safety	CWCT Section 12
Impact Testing	CWCT TN 76

Wintech Engineering Ltd is accredited by the United Kingdom Accreditation Service as UKAS Testing Laboratory No. 2223.

The test sample was supplied and erected on to the test chamber by Forterra Building Products Limited.

2. SUMMARY OF TEST RESULTS

The following summarises the results of tests carried out. The performance of the sample tested has been assessed against the criteria described in CWCT Standard Test Methods for Building Envelope – December 2005, as detailed in Section 1. The results as reported were used to determine the conformance or non-conformance without making any consideration of the uncertainty as requested by Forterra Building Products Limited.

The sample was tested in the following sequence and the associated results are as follows;

Test Type	Peak Test Pressure	Result	Date of test	Classification
Test 1 – Air Leakage (Infiltration)	600 Pa	Pass	27.03.19	A4
Test 2 – Air Leakage (Exfiltration)	100 Pa	N/A*	27.03.19	N/A
Test 3 – Water Penetration (Dynamic Aero Engine)	600 Pa	Pass	27.03.19	N/A
Test 4 – Wind Resistance (Serviceability) Backing Wall	2400 Pa	Pass	27.03.19	N/A
Test 5 – Repeat Air Leakage (Infiltration)	600 Pa	Pass	27.03.19	A4
Test 6 – Repeat Air Leakage (Exfiltration)	100 Pa	N/A*	27.03.19	N/A
Test 7 – Water Penetration (Dynamic Aero Engine)	600 Pa	Pass	27.03.19	N/A
Test 8 – Water Penetration (Hose)	-	Pass	28.03.19	N/A
Test 9 – Wind Resistance (Serviceability) Cavity	2400 Pa	Pass	28.03.19	N/A
Test 10 – Wind Resistance (Safety) Backing Wall	3600 Pa	Pass	28.03.19	N/A
Test 11 – Wind Resistance (Safety) Cavity	3600 Pa	Pass	28.03.19	N/A
Test 12a – Impact Resistance (Retention of Performance)	-	Class 3	28.03.19 29.03.19	Cat B
Test 12b – Impact Resistance (Safety to Persons)	-	Low Risk	28.03.19 29.03.19	Cat B

*There is no classification or performance requirement for exfiltration testing in CWCT Standard for Systemised Building Envelopes – Section 5.

Note: A separate test was conducted on the outer wall (cavity) as per Section 13 of Standard test methods for building envelopes to subject the rainscreen panels to loads that could not be applied during the first test.

The test sample successfully passed all of the above CWCT test requirements and all tests are either equal to or in excess of the requirements for current BS EN Standards for Curtain Walling.

THESE RESULTS ARE VALID ONLY FOR THE CONDITIONS UNDER WHICH THE TEST WAS CONDUCTED

3. DESCRIPTION OF TEST SAMPLE

Product Description

Full product name:	SureBrick
Product type:	Brick slip façade system
Product description:	Profiled brick slips clipped into a coated steel carrier rail
Manufactured by:	Forterra Building Products Limited

Support Framing and bracketry (not part of the SureBrick system, but has been tested)

Material:	Nvelope NV1 (helping hand bracket and rail system)
Finish:	Aluminium
Vertical rail Ref:	02/L60-40-2.2-3000
Horizontal rail Ref:	N/A
Fixing method (rail to backing wall):	Nvelope standard screw fixings
Fixing Ref:	04/SX3/28-S16-6.0X48
Fixing method (rail to bracket):	Nvelope standard screw fixings
Fixing Ref:	04/SDA5/5.5X22
Max Span between vertical rails:	600mm
Max Span between horizontal rails:	N/A
Brackets ref:	01/VB060D-6.5 and 01/VB060S-6.5

Panels/tiles (The SureBrick system)

Material:	Brick slip façade system
Material ref (source, spec):	Forterra Building Products Limited Specifications – see below
Finish:	Pointing Mortar – Parex Historic KL Clay brick slips – Forterra Dark Multi Smooth Forterra Chelsea Smoked Red Forterra Smooth Red Metal rails – Forterra SureBrick Rail (metal rails comprising S220GD+ZM310 hot dip zinc-magnesium coating to BS EN 10346) Forterra SureBrick Top Rail (metal rails comprising S220GD+ZM310 hot dip zinc-magnesium coating to BS EN 10346) Forterra Stainless Steel Rail (304 2B) Forterra Stainless Steel Top Rail (304 2B)
Thickness:	Metal Rails – 0.7mm Clay Brick Slips – 22mm, 42mm & 78.5mm
Reinforcing:	N/A
Max height of panel:	N/A
Max width of panel:	N/A
Max size of panel by area (m2):	N/A
Fixing method:	Metal Rails – Mechanically fixed back to supporting frame with screws. Clay Brick Slips – Mechanically retained by the interlocking of the profiled clay brick slip into the rail
Bracket/clip ref:	N/A
Screws/fixings ref:	EJOT JT3 FR 6 5.5 x 25mm EJOT JT3 LT3 5.5 x 25mm EJOT JT3 FR2 4.9 x 35mm (with and without washers)

Interface Details (Backwall to window/door inserts)

Window interface detail:	The window was fixed back to the SFS using metal straps. tremco illbruck ME501 Duo Membrane HD was installed using tremco illbruck SP525 adhesive to the exposed edge around the perimeter of the window to seal it to the sheathing board.
Door interface detail:	N/A

Backing Wall

Structural support type:	SFS
Insulation type:	No insulation used on the test
Insulation thickness:	N/A
Airtight membrane:	tremco illbruck ME011 Breather Membrane UV
Watertight membrane:	tremco illbruck ME011 Breather Membrane UV
Particle board detail:	RCM Cemboard
Sealants and tapes:	tremco illbruck SP525, ME315, ME501, SP925
Fixings ref:	EJOT WDHS 5.5 x 119mm EJOT JT3 12 5.5 x 40mm EJOT JT3 LT3 5.5 x 25mm

Drainage

Drainage type (pressure equalised etc.):	Drained (non-pressure-equalised)
Drainage specification and weep holes etc.	G950 Weep Vents, 2200mm² ventilation airflow per weep vent. Weep vents placed at not more than 1125mm centres above drainage sections and at a maximum of 450mm centres above openings (minimum 2 per opening)

Additional brackets & Fixings

Ref:	Perimeter flashings to close the cavity (test purposes only)

Sample Dimensions

Test sample size:	5390mm x 6604mm

Confirmation

Please confirm that the samples provided for testing are representative of standard production?	Confirmed

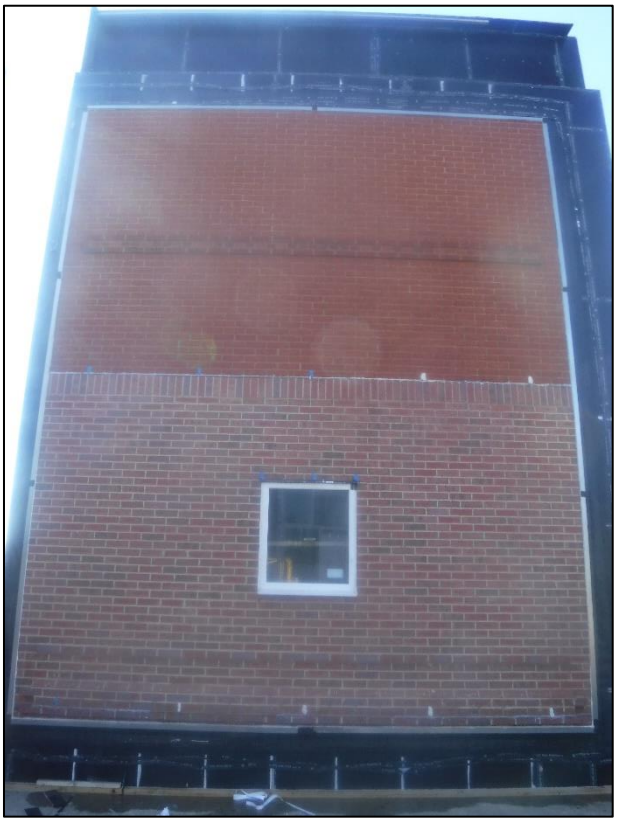
Further details of the test sample and façade system can be found in Section 7.

The description of the test sample in this section has been supplied by Forterra Building Products Limited and has not been verified by Wintech Engineering Limited.

Test Sample During Testing

Photograph No. 1

Photograph No. 2



4. TEST ARRANGEMENT

4.1 TEST CHAMBER

A rainscreen specimen, supplied for testing in accordance with CWCT requirements, was mounted on to a rigid test chamber constructed from steel, timber and plywood sheeting.

The pressure within the chamber was controlled by means of a centrifugal fan and a system of ducting and valves. The static pressure difference between the outside and inside of the chamber was measured by means of a differential pressure transmitter.

4.2 INSTRUMENTATION

4.2.1 Static Pressure

A differential pressure transmitter capable of measuring rapid changes in pressure to an accuracy within 2%, was used to measure the pressure differential across the sample.

4.2.2 Air Flow

A Laminar flow element, mounted in the air system ducting, was used along with differential pressure transducers to measure the airflow required to obtain pressures within the test chamber and has the capability of measuring airflow through the sample to an accuracy within 2%.

4.2.3 Water Flow

An in-line flowmeter, mounted in the spray frame water supply system, was used to measure water flow to the test sample to an accuracy of $\pm$ 5%.

4.2.4 Deflection

Digital linear measurement devices with an accuracy of +/- 0.1 mm were used to measure deflection of principle framing members.

4.2.5 Temperature & Humidity

A digital data logger capable of measuring temperature with an accuracy of ± 1°C and humidity with an accuracy of ± 5 %Rh was used.

4.2.6 Atmospheric Pressure

A digital barometer was used to take atmospheric pressure readings with an accuracy of ± 1Kpa.

4.2.7 General

Electronic instrument measurements were scanned by a computer controlled data logger, which processed and recorded the results.

4.3 PRESSURE GENERATION

Note: References are made to both positive and negative pressures in this document, it should be noted that in these instances, positive pressure is when pressure on the weather face of the sample is greater than that on the inside face and vice versa.

4.3.1 Static Air Pressure

The air supply system comprised of a centrifugal fan assembly and associated ducting and control valves which were used to create both positive and negative static pressure differentials. The fan provided a constant airflow at the required pressure and period required for the tests.

4.3.2 Dynamic Aero Engine

A wind generator was mounted adjacent to the external face of the test sample and used to create positive pressure differential during dynamic testing.

4.4 WATER SPRAY

4.4.1 Spray frame arrangement

A water spray system was used which comprised of nozzles spaced on a uniform grid, not more that 700 mm apart and mounted approximately 400 mm from the face of the sample. The nozzles provided a full cone pattern, as per the requirements outlined by CWCT. The system delivered water uniformly to the entire surface of the test sample at a rate of not less than 3.4 lt/m^2/min.

4.4.2 Hose arrangement

The water was applied using a brass nozzle which produced a solid cone of water droplets with a nominal spread of 30°. The nozzle was provided with a control valve and a pressure gauge between the valve and the nozzle. The water flow to the nozzle was adjusted to produce 22 $\pm$ 2 litre/min when the water pressure at the nozzle inlet was 220 $\pm$ 20kPa.

4.5 IMPACTORS

4.5.1 Soft (S1) Body Impactor

A spherical/conical, glass bead filled impactor with a mass of 50 Kg as required in CWCT TN 76.

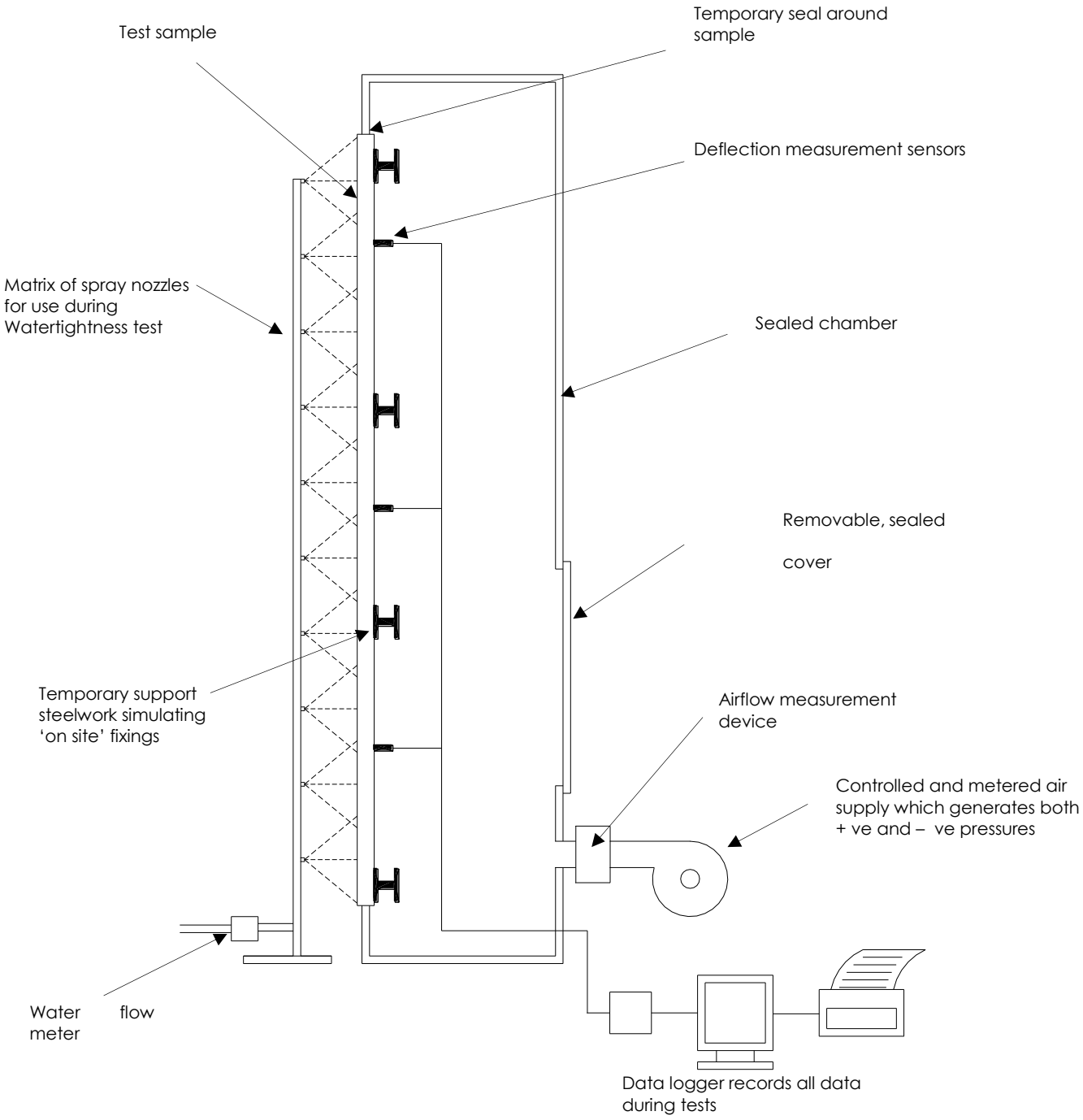
4.5.2 Hard (H2) Body Impactor

A steel ball with a diameter of 62.5 mm and a mass of 1.135 kg, modified to allow it to swing from a nylon cord, rather than being dropped onto the sample as required in CWCT TN 76, was released from the specified height and allowed to fall under gravity until it impacts the designated test zone of the sample.

All measurement devices, instruments and other relevant equipment were calibrated and are traceable to National Standards.

Figure 1

General Arrangement of a Typical Test Assembly



5. TEST PROCEDURES

5.1 SEQUENCE OF TESTING

1. Air Leakage – Infiltration
2. Air Leakage – Exfiltration
3. Water Penetration – Dynamic Aero Engine
4. Wind Resistance – Serviceability – Backing Wall
5. Repeat Air Leakage – Infiltration
6. Repeat Air Leakage – Exfiltration
7. Water Penetration – Dynamic Aero Engine
8. Water Penetration - Hose
9. Wind Resistance – Serviceability – Cavity
10. Wind Resistance – Safety – Backing Wall
11. Wind Resistance – Safety – Cavity

12a. Hard & Soft Body impact test – Retention of performance

12b. Hard & Soft Body impact test - Safety to persons

5.2 AIR LEAKAGE

5.2.1 Infiltration

Three (3) preparatory pulses of **660 Pa (110% of peak test pressure)** positive pressure were applied to the test sample. An airtight seal comprising of plastic sheeting and adhesive tape was then attached to the face of the test sample.

Leakage through the test chamber and joints between the chamber and test sample was determined by measuring the air flow at the following positive pressures; **50, 100, 150, 200, 250, 300, 450 and 600 Pa** each step being held for at least 10 seconds.

Test results for the sample were determined by repeating the above sequence with the sample unsealed. The difference between the readings being the air leakage through the sample.

A check for concentrated air leakage was conducted following the above sequence.

5.2.2 Exfiltration

Three (3) preparatory pulses of **500 Pa** negative pressure were applied to the test sample. An airtight seal comprising of plastic sheeting and adhesive tape was then attached to the face of the test sample.

Leakage through the test chamber and joints between the chamber and test sample was determined by measuring the air flow at the following negative pressure; **50 and 100 Pa**, this step being held for at least 10 seconds.

Test results for the sample were determined by repeating the above sequence with the sample unsealed. The difference between the readings being the air leakage through the sample.

5.3 WATER PENETRATION

5.3.1 Water Penetration – Dynamic Aero Engine

Water was sprayed on to the sample as described in section 4.4.1.

The sample was subjected to airflow from the wind generator, as described in 4.3.2, which achieved average deflections equal to those produced at a static pressure differential of **600 Pa** and these conditions were met for the specified 15 minutes.

The interior face of the sample was continuously monitored for water ingress throughout the test.

5.3.2 Water Penetration – Hose Test

Working from the exterior, selected areas of window pod contained within the system were wetted from the bottom up, progressing from the lowest horizontal joint then the intersecting vertical joints.

Water was applied to the sample for 5 mins per 1.5 m length of joint, as described in section 4.4.2.

Throughout the water penetration testing, and for 30 minutes following the cessation of spraying, the internal face of the sample was examined for water penetration. The emergence of any water on the inside face would be recorded, and the location and extent of any leakage noted on a drawing of the test specimen.

5.4 WIND RESISTANCE

5.4.1 Wind Resistance – Serviceability

Three (3) preparatory pulses of **1200 Pa** positive pressure were applied to the test sample. Upon returning to 0 Pa, any opening parts of the test specimen were opened and closed five (5) times, secured in the closed position and finally sealed with tape. All deflection sensors were then zeroed.

The sample was then subjected to positive pressure stages of **600, 1200, 1800 and 2400 Pa (25%, 50%, 75% and 100% of design wind load)** and held at each step for 15 seconds (± 5 secs).

The deformation status of the sample was recorded at each step at characteristic points as stated in the standard, following which the pressure was reduced to 0 Pa and any residual deformations recorded within 1 hour of the test.

The above test sequence was then repeated, including the preparation pulses at a negative pressure differential.

5.4.2 Wind Resistance – Safety

Three preparatory positive air pressure pulses of **1200 Pa** positive pressure were applied to the test sample, and the deflection sensors were zeroed.

The sample was subjected to a positive pressure pulse of **3600 Pa (2400 Pa x 150%)**. The pressure was applied as rapidly as possible but in not less than 1 second and was maintained for 15 seconds (± 5 secs).

Following this pressure pulse and upon returning to zero (0) pressure, residual deformations were recorded and any change in the condition of the specimen was noted.

After the above sequence, a visual inspection was conducted, any moving parts were operated and any damage or functional defects noted.

The above test sequence was then repeated, including the preparation pulses at a negative pressure differential.

Following each of the above tests, the sample was inspected for any permanent deformation or damage.

5.5 IMPACTING

5.5.1 Impact Test Procedure – Retention of performance

The test sample was tested using a drop height which corresponded with the required performance level.

The Impactors, as described in section 4.5, were suspended on a wire/Nylon cord and allowed to swing freely, without initial velocity, in a pendulum motion until they hit the sample normal to its face. Only one impact was performed at any single position during the hard body impacting and three times at each position during the soft body impacting.

Tests were conducted at the required impact energies as shown in section 6.4.1 to the selected impact points and the impactors were not allowed to strike the sample more than once.

Drop heights were set to an accuracy of ± 10 mm.

5.5.2 Impact Test Procedure – Safety to persons

The test sample was tested using a drop height which corresponded with the required performance level.

The Impactors, as described in section 4.5, were suspended on a wire/Nylon cord and allowed to swing freely, without initial velocity, in a pendulum motion until they hit the sample normal to its face. Only one impact was performed at any single position.

Tests were conducted at the required impact energies as shown in section 6.4.2 to the selected impact points and the impactors were not allowed to strike the sample more than once.

Drop heights were set to an accuracy of ± 10 mm.

5.5.3 Exposure Categories

The above tests were conducted to Category B as required by Forterra Building Products Limited as one of the categories from the table below taken from CWCT TN 75.

Areas within 1.5m of ground		
	Description	Examples
A	Readily accessible to the public and others with little incentive to exercise care. Prone to vandalism and abnormally rough use.	External walls in vandal prone areas.
B	Readily accessible to the public and others with little incentive to exercise care. Chance of accident occurring and of misuse.	Walls adjacent to pedestrian thoroughfares when not in category A.
C	Accessible primarily to those with some incentive to exercise care. Some chance of accident occurring or of misuse.	Walls adjacent to private open gardens. Back walls of balconies.
D	Only accessible, but not near common route, to those with a high incentive to exercise care. Small chance of accident or of misuse.	Walls adjacent to small fenced decorative garden with no through paths.
Areas more than 1.5m above ground		
E	Above zone of normal impacts from people and not liable to impacts from thrown or kicked objects. May also be subject to impact during maintenance.	1.5 to 6m above pedestrian level in location categories A and B.
F	Above zone of normal impacts from people and not liable to impacts from thrown or kicked objects. May also be subject to impact during maintenance.	Wall surfaces at higher positions than those defined in E above.

6. TEST RESULTS

6.1 AIR LEAKAGE

6.1.1 Calculated Permissible Air Infiltration of Test Sample

Permissible air infiltration rate as CWCT standard test methods for building envelopes – section 5:
Fixed Area = 1.5 $m^3/hr/m^2$

The permissible air infiltration rate at intermediate test pressures was determined as specified by CWCT standard test methods for building envelopes – section 5.

Air permeability measured at maximum test pressure in the 2nd test should not increase by more than 0.3 $m^3/hr/m^2$ for fixed glazing above those recorded in the 1st test, as required in CWCT standard for systemised building envelopes: section 3 & BS EN 13116: 2001.

Measured area of test sample = **36.2 m^2**

6.1.2 Air Leakage – Classification

Classification according to CWCT & BS EN 12152: 2002

Test 1 – Infiltration – Fixed glazing	A4

Note: There is no classification requirement for exfiltration testing in CWCT standard for systemised building envelopes – Section 5. However, Approved Document L2 requires a maximum air leakage rate of 10 $m^3/hr/m^2$ @ 50 Pa for a completed building envelope.

6.1.3 Fixed Area

	Maximum Air Permeability Rate –Infiltration $m^3/hr/m^2$				Maximum Air Permeability Rate – Exfiltration $m^3/hr/m^2$			
Pressure Differential Pa	**Test No. 1**		**Test No. 5**		**Test No. 2**		**Test No. 6**	
	Ambient ° C	**12.3**	**Ambient ° C**	**11.2**	**Ambient ° C**	**12.3**	**Ambient ° C**	**11.2**
50	**0.01**		**0.00**		**0.06**		**0.00**	
100	**0.01**		**0.00**		**0.06**		**0.03**	
150	**0.01**		**0.00**					
200	**0.01**		**0.00**					
250	**0.00**		**0.00**					
300	**0.01**		**0.00**					
450	**0.01**		**0.01**					
600	**0.01**		**0.01**					

Observations
No areas of concentrated leakage were found during testing.

Note: The standard uncertainty multiplied by a coverage factor k = 2, providing a level of confidence of approximately 95%, for the above measurements is + 5.33 % of the reading

Figure 2

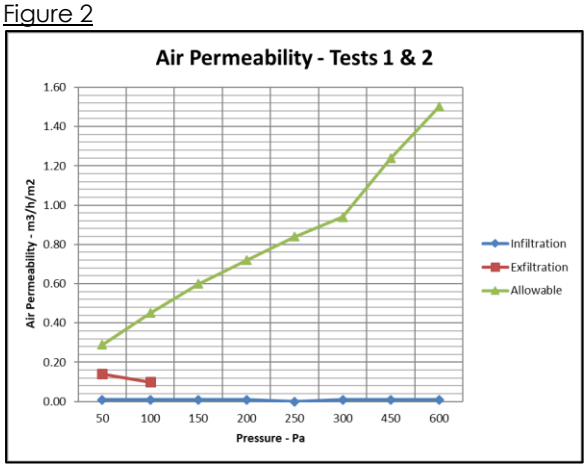
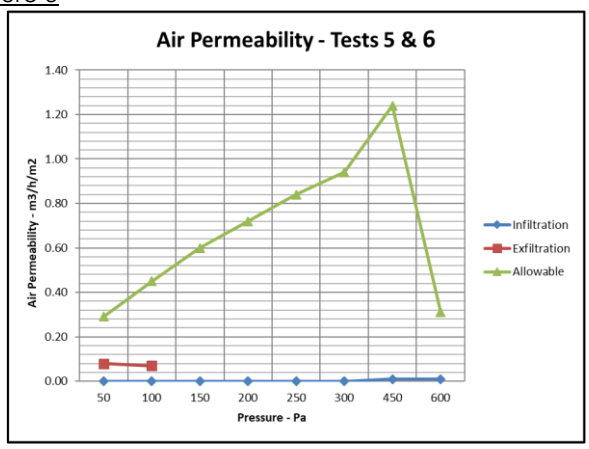


Figure 3



6.2 WATER PENETRATION

6.2.1 Test 3 – Water Penetration – Dynamic Aero Engine

Temperatures (°C)		
	Water	10.8
	Ambient	12.3

Observations
The sample was subjected to testing as described in section 5.3.1, for a period of not less than 15 minutes, during which no water leakage was observed through the sample.

6.2.2 Test 7 – Water Penetration – Dynamic Aero Engine

Temperatures (°C)		
	Water	8.1
	Ambient	11.1

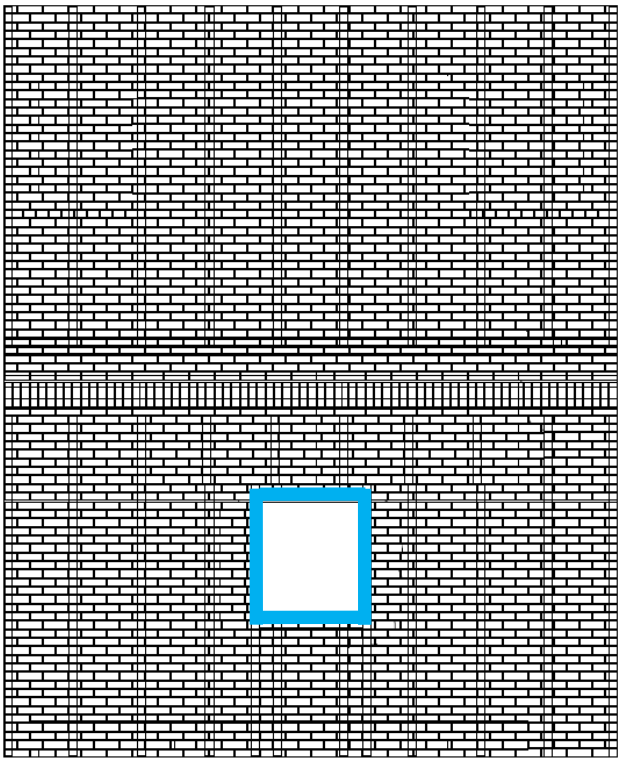
Observations
The sample was subjected to testing as described in section 5.3.1, for a period of not less than 15 minutes, during which no water leakage was observed through the sample.

6.2.3 Test 8 – Water Penetration – Hose

Observations
The sample was subjected to hose testing, as described in section 5.3.2. During the test, and for 30 minutes following the cessation of spraying, the sample was monitored for water ingress and none was found.

Figure 4

Hose Test Areas



Hose Test Areas:

View from Outside
Not to Scale

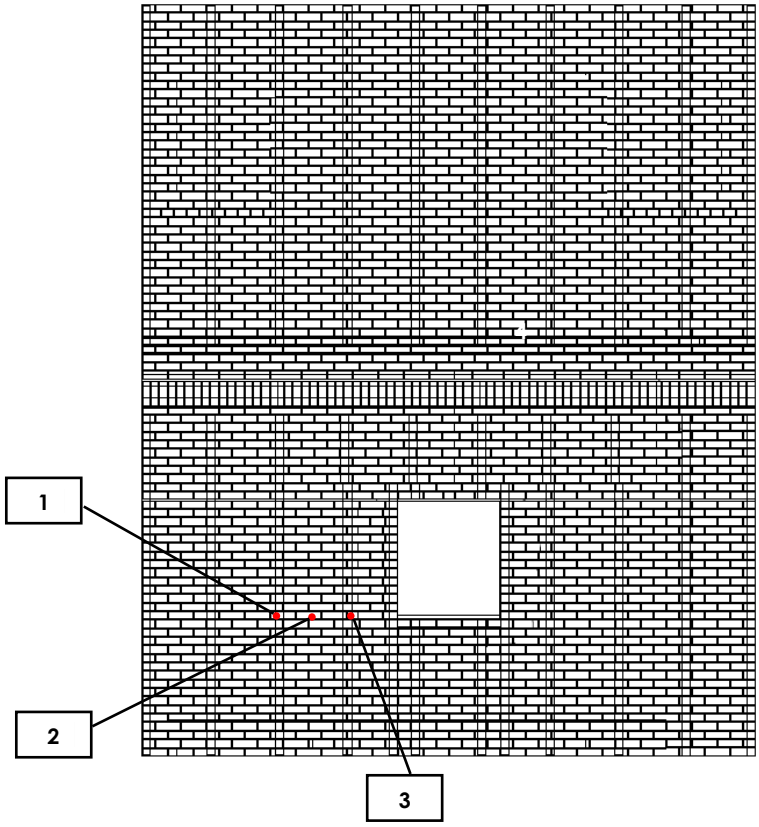
6.3 WIND RESISTANCE TESTING

Calculation of deflection

Probe 2 – ((Probe 1 + Probe 3)/2)

An inspection carried out following tests 5 and 10, after both positive and negative pressure testing, showed no evidence of any permanent deformation or damage to the test sample.

Figure 5 - Positions of Deflection Measurement Probes



- Deflection probe position

View from Outside
Not to Scale

6.3.1 Test 9 - Wind Resistance, Serviceability

Temperatures (°C)	Ambient	11.9

Measured Length of Framing Member (mm)	Allowable Deflection	
	Ratio	Calculated (mm)
600	L/360	1.7

Frontal deflection shall recover by either 95%, or 1mm, whichever the greater.

6.3.1.1 Wind Resistance, Serviceability - Positive Pressure

Positive Pressure (Pa)	Results (mm)
0	0.0
600	0.0
1200	0.1
1800	0.3
2400	0.5
Residuals Immediately following test	0.0

6.3.1.2 Wind Resistance, Serviceability - Negative Pressure

Negative Pressure (Pa)	Results (mm)
0	0.0
600	0.1
1200	0.0
1800	0.1
2400	0.2
Residuals Immediately following test	0.0

6.3.2 Tests 11 - Wind Resistance, Safety

Temperatures (°C)	Ambient	11.9

Measured Length of Framing Member (mm)	Allowable Residual Deformation	
	Ratio	Calculated (mm)
600	L/500	1.2

6.3.2.1 Wind Resistance, Safety - Positive Pressure

Positive Pressure (Pa)	Results (mm)
0	0.0
3600	0.2
Residuals Immediately following test	0.0

6.3.2.2 Wind Resistance, Safety - Negative Pressure

Negative Pressure (Pa)	Results (mm)
0	0.0
3600	0.2
Residuals Immediately following test	0.0

Note: The standard uncertainty multiplied by a coverage factor k = 2, providing a level of confidence of approximately 95%, for the above measurements is ± 2.4 % of the reading

6.4 IMPACT TESTING

6.4.1 Test 12a – Impact – Retention of performance

Following each impact, the sample was examined for damage and classified in accordance with the criteria defined in the table below taken from CWCT TN 75.

Class	Definition	Explanation/Examples
1	No damage	No damage visible from 1m, and Any damage visible from closer than 1m unlikely to lead to significant deterioration.
2	Surface damage of an aesthetic nature which is unlikely to require remedial action	Dents or distortion of panels not visible from more than 5m (note visibility of damage will depend on surface finish and lighting conditions. Damage will generally be more visible on reflective surfaces), and Any damage visible from closer than 5m unlikely to lead to significant deterioration
3	Damage that may require remedial action or replacement of components to maintain appearance or long term performance but does not require immediate action	Dents or distortion of panels visible from more than 5m, or Spalling of edges of panels of brittle materials, or Damage to surface finishes that could lead to deterioration of the substrate.
4	Damage requiring immediate action to maintain appearance or performance. Remedial action may include replacement of panel but does not require dismantling or replacement of supporting structure	Significant cracks in brittle materials eg cracks that may lead to parts of tile falling away subsequent to test, or Fracture of panels causing significant amounts of material to fall away during test.
5	Damage requiring more extensive replacement than 4	Buckling of support rails

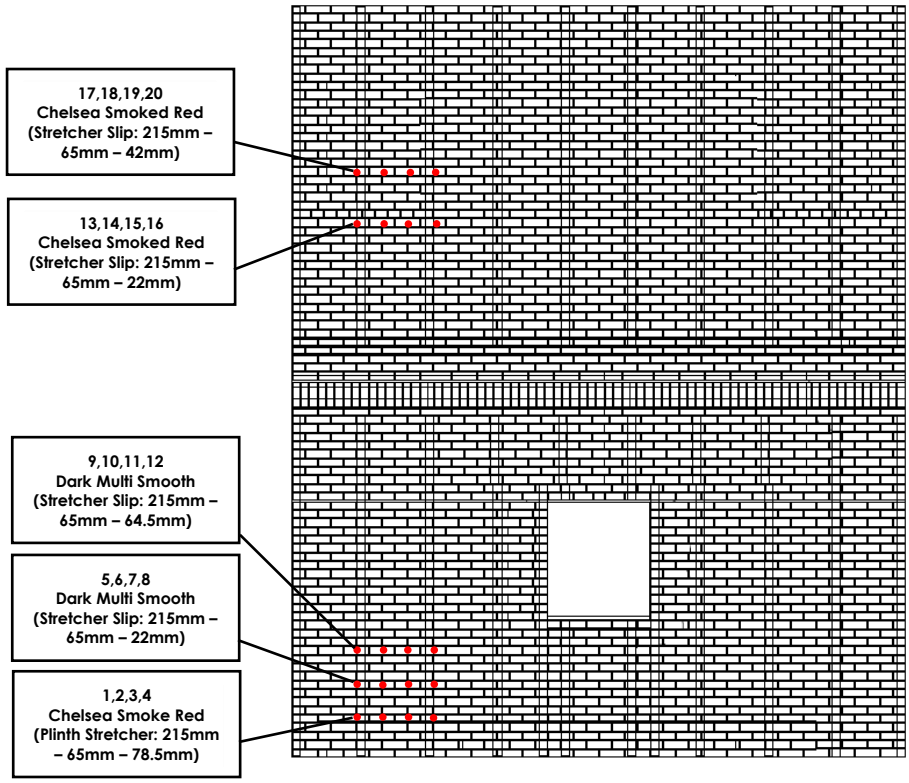
28th March 2019

Ambient Temperature (°C)	9.1	Humidity (%)	59

Soft Body Impactor (S1) – Category B			
Impact Energy (Nm)	**120**	**Drop Height (mm)**	**245**

Impact Location	Observations	Class
1	No damage	Class 1
2	No damage	Class 1
3	No damage	Class 1
4	No damage	Class 1
5	No damage	Class 1
6	No damage	Class 1
7	No damage	Class 1
8	No damage	Class 1
9	No damage	Class 1
10	No damage	Class 1
11	No damage	Class 1
12	No damage	Class 1
13	No damage	Class 1
14	No damage	Class 1
15	No damage	Class 1
16	No damage	Class 1
17	No damage	Class 1
18	No damage	Class 1
19	No damage	Class 1
20	No damage	Class 1

Figure 6 – Retention of performance (Soft Body) Impact positions



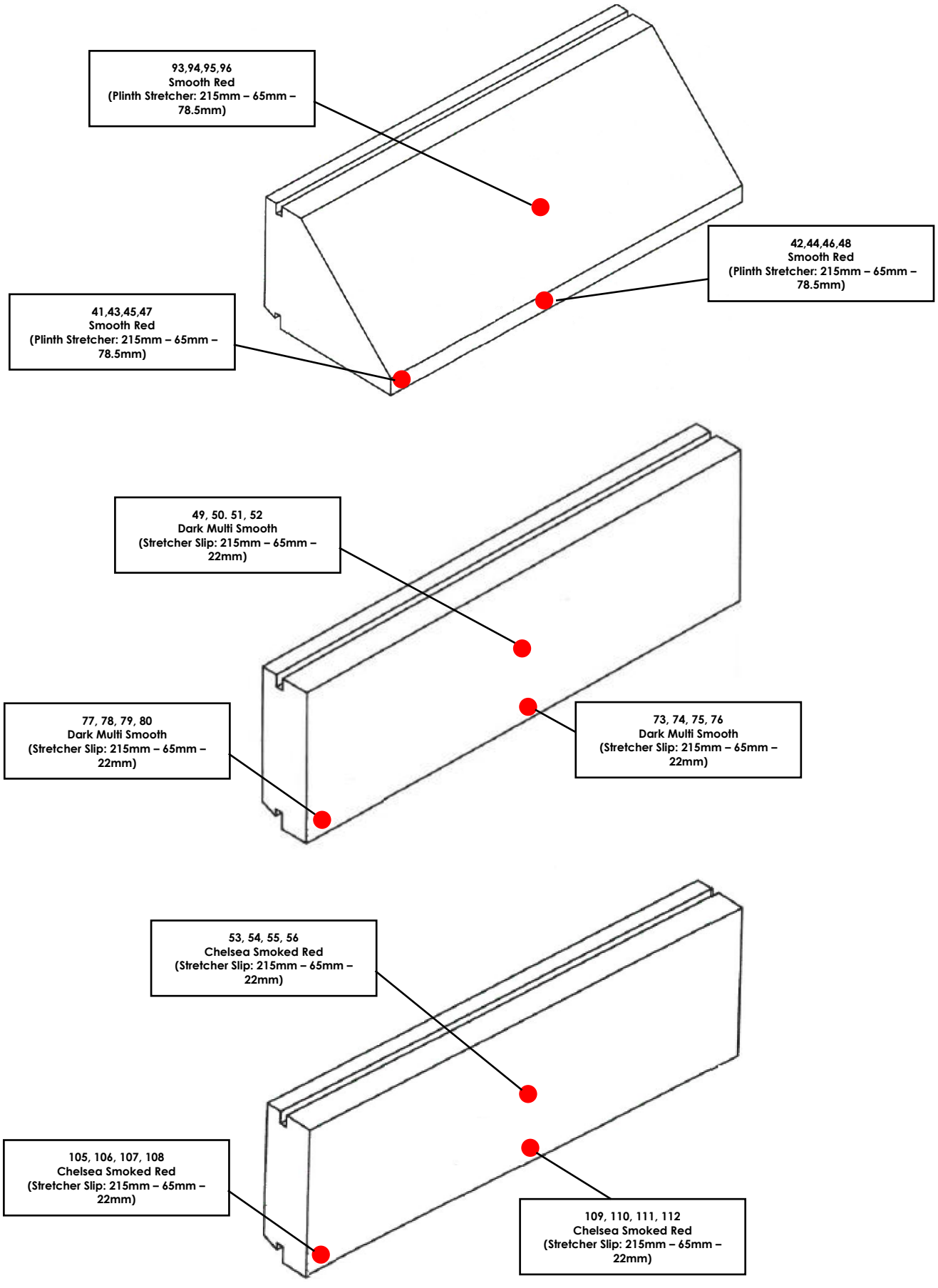
28th March 2019	**Ambient Temperature (°C)**	9.1	**Humidity (%)**	59
29th March 2019	**Ambient Temperature (°C)**	8.2	**Humidity (%)**	63

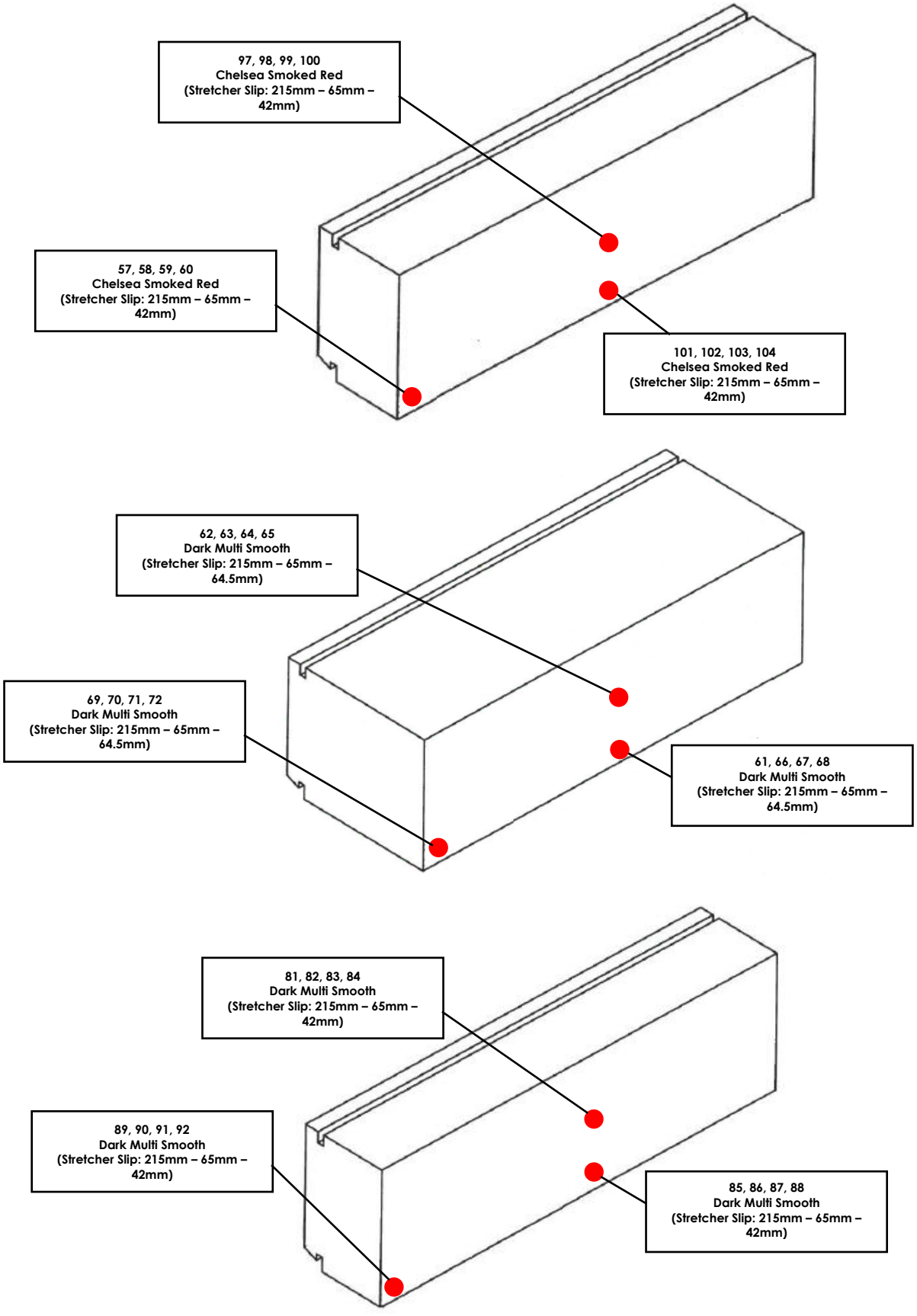
Hard Body Impactor (H2) – Category B			
Impact Energy (Nm)	**10**	**Drop Height (mm)**	**898**

Impact Location	Observations	Class
41	Small chip - 0.09g collected	Class 3
42	Mortar cracked – safely retained	Class 2
43	Mortar cracked – safely retained	Class 3
44	Small indentation left in brick	Class 2
45	Mortar cracked; brick safely retained	Class 2
46	Small crack in brick	Class 2
47	Crack at location of impact 46 made worse and hairline crack left in brick - 0.20g collected	Class 3
48	Hair line crack along length of brick	Class 2
49	Hair line crack in brick	Class 2
50	Hair line crack in brick	Class 2
51	Hair line crack in brick	Class 2
52	Hair line crack in brick	Class 2
53	No damage	Class 1
54	No damage	Class 1
55	No damage	Class 1
56	No damage	Class 1
57	No damage	Class 1
58	No damage	Class 1
59	No damage	Class 1
60	No damage	Class 1
61	No Damage	Class 1
62	Crack in mortar	Class 2

63	No Damage	Class 1
64	No Damage	Class 1
65	No Damage	Class 1
66	No Damage	Class 1
67	Small amount of mortar fell away - 0.38g collected	Class 3
68	Piece fell from adjacent brick - 2.95g collected	Class 3
69	Crack in mortar	Class 2
70	No Damage	Class 1
71	No Damage	Class 1
72	Crack in mortar	Class 2
73	No Damage	Class 1
74	Crack in mortar	Class 2
75	Crack in mortar	Class 2
76	Hairline crack in brick	Class 2
77	Cracked brick twice - safely retained	Class 2
78	No Damage	Class 1
79	Cracked brick twice - safely retained	Class 2
80	Cracked brick - safely retained	Class 2
81	Cracked down the middle of brick	Class 2
82	Cracked down the middle of brick	Class 2
83	Cracked down the middle of brick	Class 2
84	Cracked down the middle of brick	Class 2
85	Hair line crack in brick	Class 2
86	Hair line crack in brick	Class 2
87	No Damage	Class 1
88	No Damage	Class 1
89	No Damage	Class 1
90	No Damage	Class 1
91	No Damage	Class 1
92	No Damage	Class 1
93	No Damage	Class 1
94	No Damage	Class 1
95	No Damage	Class 1
96	No Damage	Class 1
97	No Damage	Class 1
98	No Damage	Class 1
99	No Damage	Class 1
100	No Damage	Class 1
101	No Damage	Class 1
102	No Damage	Class 1
103	No Damage	Class 1
104	No Damage	Class 1
105	Broke corner of brick - 2.24g collected	Class 3
106	No Damage	Class 1
107	No Damage	Class 1
108	No Damage	Class 1
109	No Damage	Class 1
110	No Damage	Class 1
111	No Damage	Class 1
112	No Damage	Class 1

Figure 7 – Retention of performance (Hard Body) Impact positions




97, 98, 99, 100
Chelsea Smoked Red
(Stretcher Slip: 215mm – 65mm – 42mm)
57, 58, 59, 60
Chelsea Smoked Red
(Stretcher Slip: 215mm – 65mm – 42mm)
101, 102, 103, 104
Chelsea Smoked Red
(Stretcher Slip: 215mm – 65mm – 42mm)
62, 63, 64, 65
Dark Multi Smooth
(Stretcher Slip: 215mm – 65mm – 64.5mm)
69, 70, 71, 72
Dark Multi Smooth
(Stretcher Slip: 215mm – 65mm – 64.5mm)
61, 66, 67, 68
Dark Multi Smooth
(Stretcher Slip: 215mm – 65mm – 64.5mm)
81, 82, 83, 84
Dark Multi Smooth
(Stretcher Slip: 215mm – 65mm – 42mm)
89, 90, 91, 92
Dark Multi Smooth
(Stretcher Slip: 215mm – 65mm – 42mm)
85, 86, 87, 88
Dark Multi Smooth
(Stretcher Slip: 215mm – 65mm – 42mm)

6.4.2 Test 12b – Impact – Safety

Following each impact, the sample was examined for damage and classified in accordance with the criteria defined in the table below taken from CWCT TN 75.

Class	Explanation/Examples
Negligible risk	No material dislodged during test, and no damage likely to lead to materials falling subsequent to test, and no sharp edges produced that would be likely to cause severe injury to a person during impact, and cladding not penetrated by impactor
Low risk	Maximum mass of falling particle 50g, and Maximum mass of particle that may fall subsequent to impact 50g, and cladding not penetrated by impact, and no sharp edges produced that would be likely to cause severe injury during impact
Moderate risk	Maximum mass of falling particle less than 500g, and maximum mass of particle that may fall subsequent to impact less than 500g, and cladding not penetrated by impact, and no sharp edges produced that would be likely to cause severe injury during impact
High risk	Maximum mass of falling particle greater than 500g, or cladding penetrated by impact, or sharp edges produced that would be likely to cause severe injury during impact.

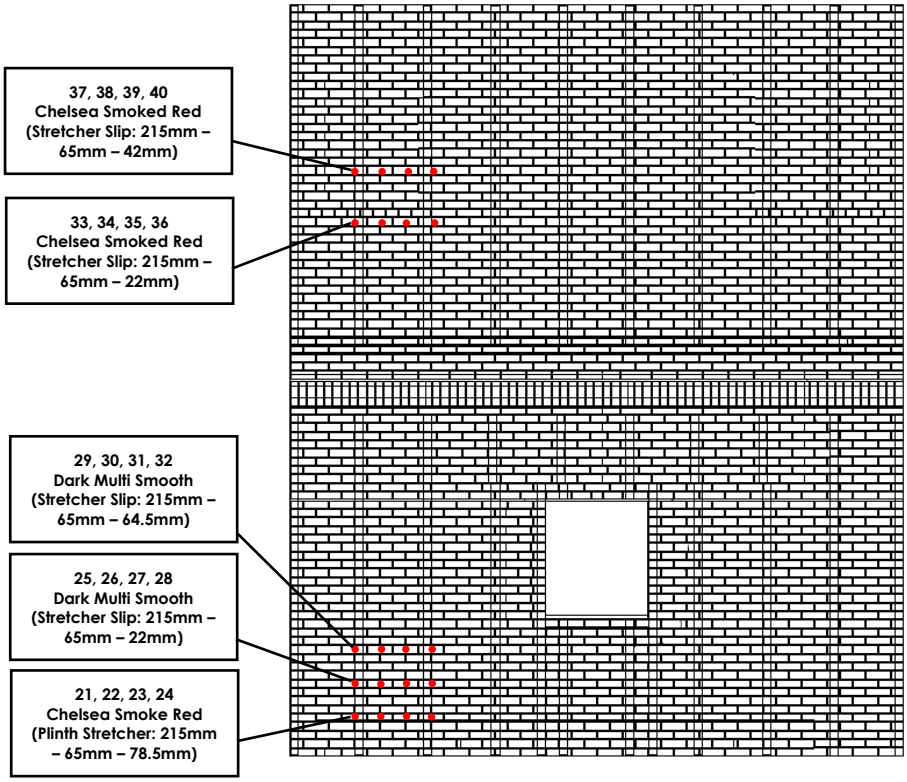
28th March 2019

Ambient Temperature (°C)	9.1	Humidity (%)	59

Soft Body Impactor (S1) – Category B			
Impact Energy (Nm)	**500**	**Drop Height (mm)**	**1020**

Impact Location	Observations	Risk Category
21	No damage	Negligible
22	No damage	Negligible
23	No damage	Negligible
24	No damage	Negligible
25	No damage	Negligible
26	No damage	Negligible
27	No damage	Negligible
28	No damage	Negligible
29	No damage	Negligible
30	No damage	Negligible
31	No damage	Negligible
32	No damage	Negligible
33	No damage	Negligible
34	No damage	Negligible
35	No damage	Negligible
36	No damage	Negligible
37	No damage	Negligible
38	No damage	Negligible
39	No damage	Negligible
40	No damage	Negligible

Figure 8 – Safety (Soft Body) Impact positions



28th March 2019	**Ambient Temperature (°C)**	9.1	**Humidity (%)**	59
29th March 2019	**Ambient Temperature (°C)**	8.2	**Humidity (%)**	63

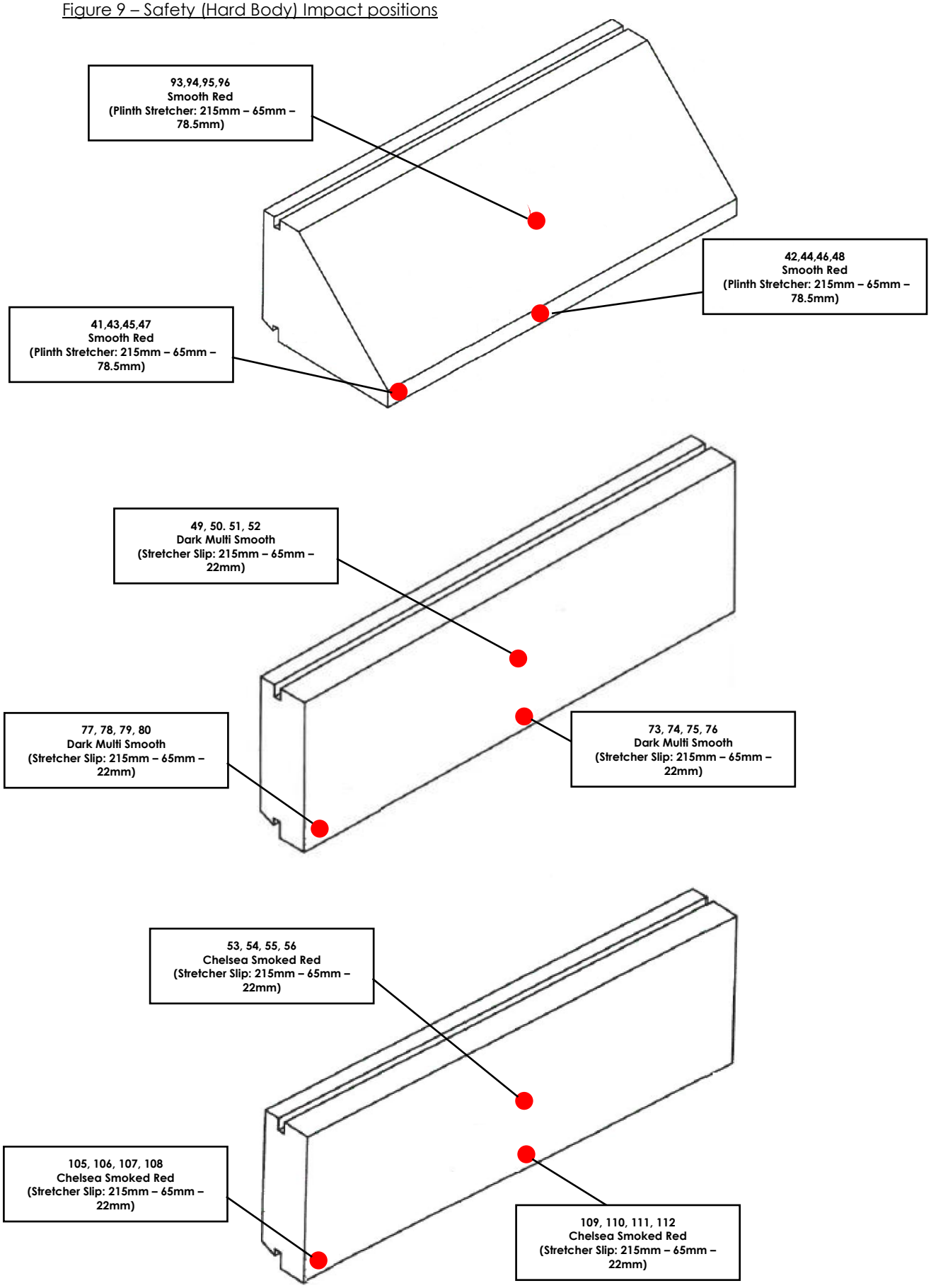
Hard Body Impactor (H2) – Category B			
Impact Energy (Nm)	**10**	**Drop Height (mm)**	**898**

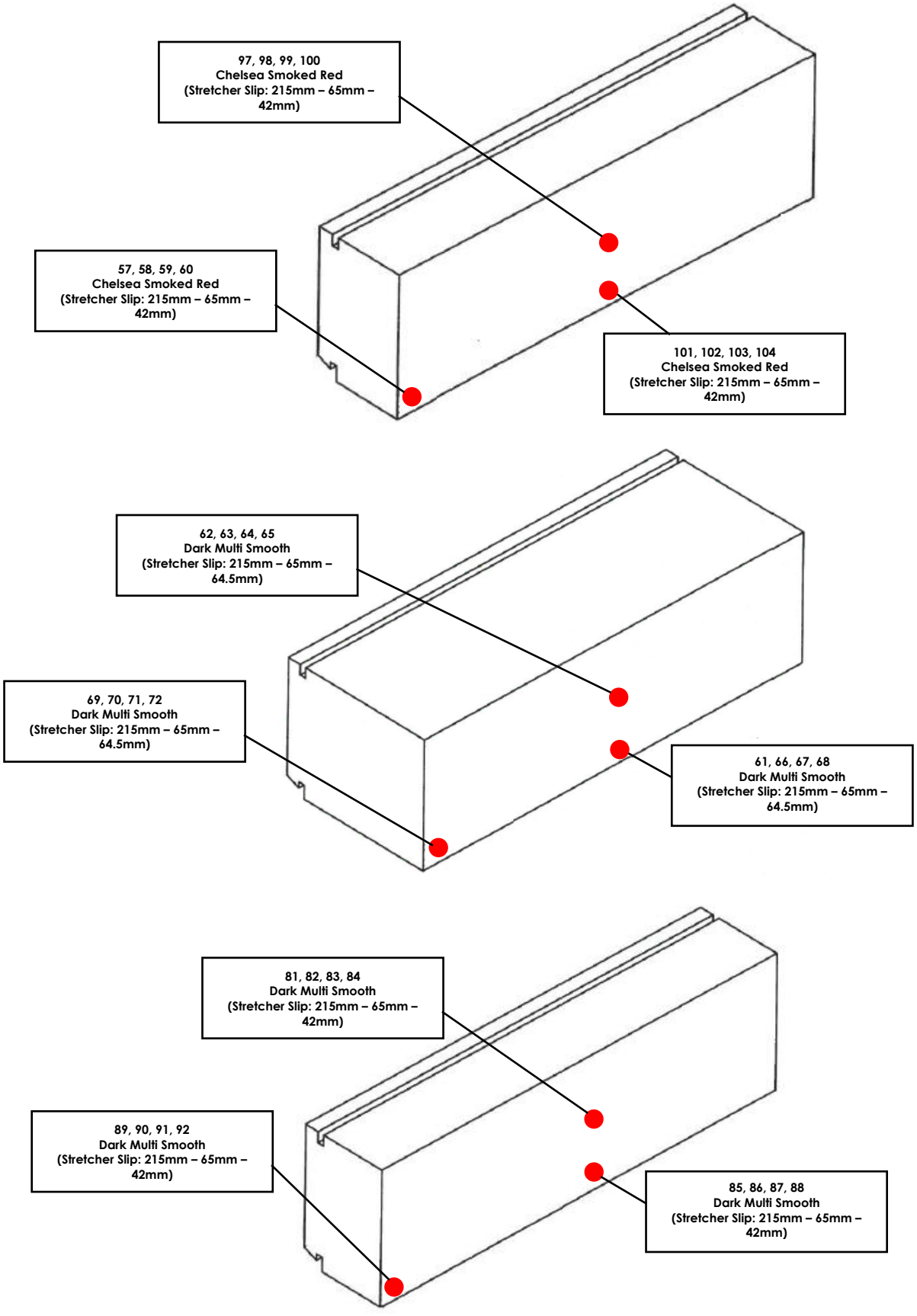
Impact Location	**Observations**	**Risk Category**
41	Small chip - 0.09g collected	Low
42	Mortar cracked – safely retained	Negligible
43	Mortar cracked – safely retained	Negligible
44	Small indentation left in brick	Low
45	Mortar cracked; brick safely retained	Negligible
46	Small crack in brick	Negligible
47	Crack at location of impact 46 made worse and hairline crack left in brick - 0.20g collected	Low
48	Hair line crack along length of brick	Negligible
49	Hair line crack in brick	Negligible
50	Hair line crack in brick	Negligible
51	Hair line crack in brick	Negligible
52	Hair line crack in brick	Negligible
53	No damage	Negligible
54	No damage	Negligible
55	No damage	Negligible
56	No damage	Negligible
57	No damage	Negligible
58	No damage	Negligible
59	No damage	Negligible
60	No damage	Negligible
61	No Damage	Negligible

62	Crack in mortar	Negligible
63	No Damage	Negligible
64	No Damage	Negligible
65	No Damage	Negligible
66	No Damage	Negligible
67	Small amount of mortar fell away - 0.38g collected	Low
68	Piece fell from adjacent brick - 2.95g collected	Low
69	Crack in mortar	Negligible
70	No Damage	Negligible
71	No Damage	Negligible
72	Crack in mortar	Negligible
73	No Damage	Negligible
74	Crack in mortar	Negligible
75	Crack in mortar	Negligible
76	Hairline crack in brick	Negligible
77	Cracked brick twice - safely retained	Negligible
78	No Damage	Negligible
79	Cracked brick twice - safely retained	Negligible
80	Cracked brick - safely retained	Negligible
81	Cracked down the middle of brick	Negligible
82	Cracked down the middle of brick	Negligible
83	Cracked down the middle of brick	Negligible
84	Cracked down the middle of brick	Negligible
85	Hair line crack in brick	Negligible
86	Hair line crack in brick	Negligible
87	No Damage	Negligible
88	No Damage	Negligible
89	No Damage	Negligible
90	No Damage	Negligible
91	No Damage	Negligible
92	No Damage	Negligible
93	No Damage	Negligible
94	No Damage	Negligible
95	No Damage	Negligible
96	No Damage	Negligible
97	No Damage	Negligible
98	No Damage	Negligible
99	No Damage	Negligible
100	No Damage	Negligible
101	No Damage	Negligible
102	No Damage	Negligible
103	No Damage	Negligible
104	No Damage	Negligible
105	Broke corner of brick - 2.24g collected	Low
106	No Damage	Negligible
107	No Damage	Negligible
108	No Damage	Negligible
109	No Damage	Negligible
110	No Damage	Negligible
111	No Damage	Negligible
112	No Damage	Negligible

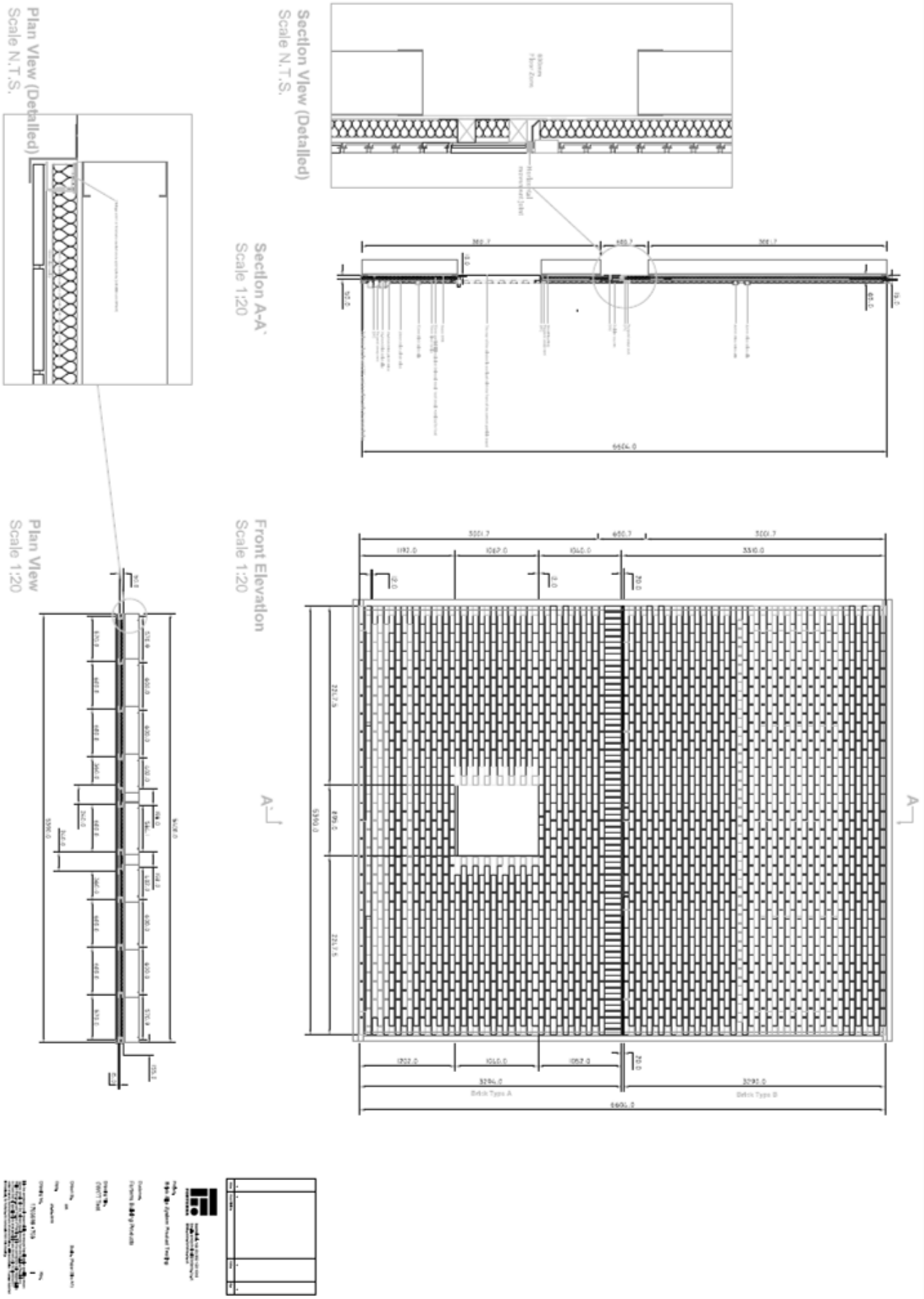
NOTE: The hard body impacting for safety to persons was conducted during the retention of performance impacting due to the impact energy being the same.

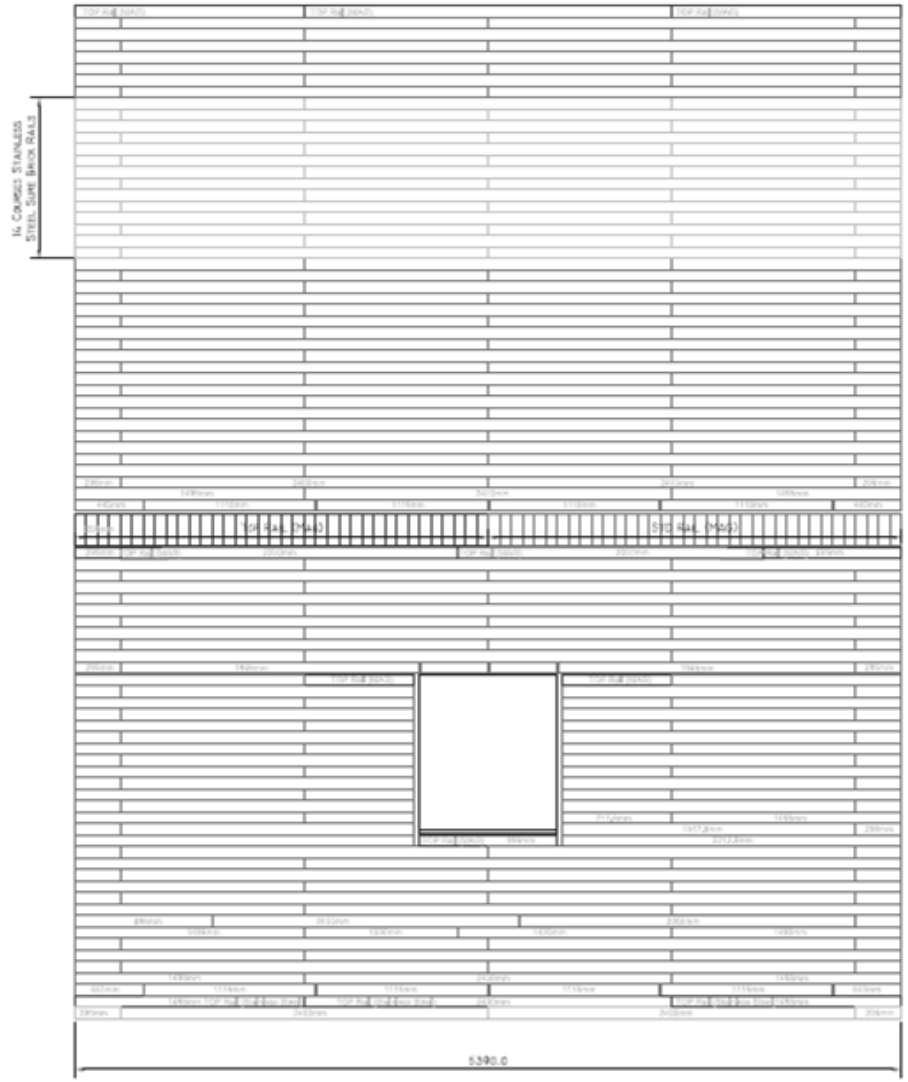
Figure 9 – Safety (Hard Body) Impact positions



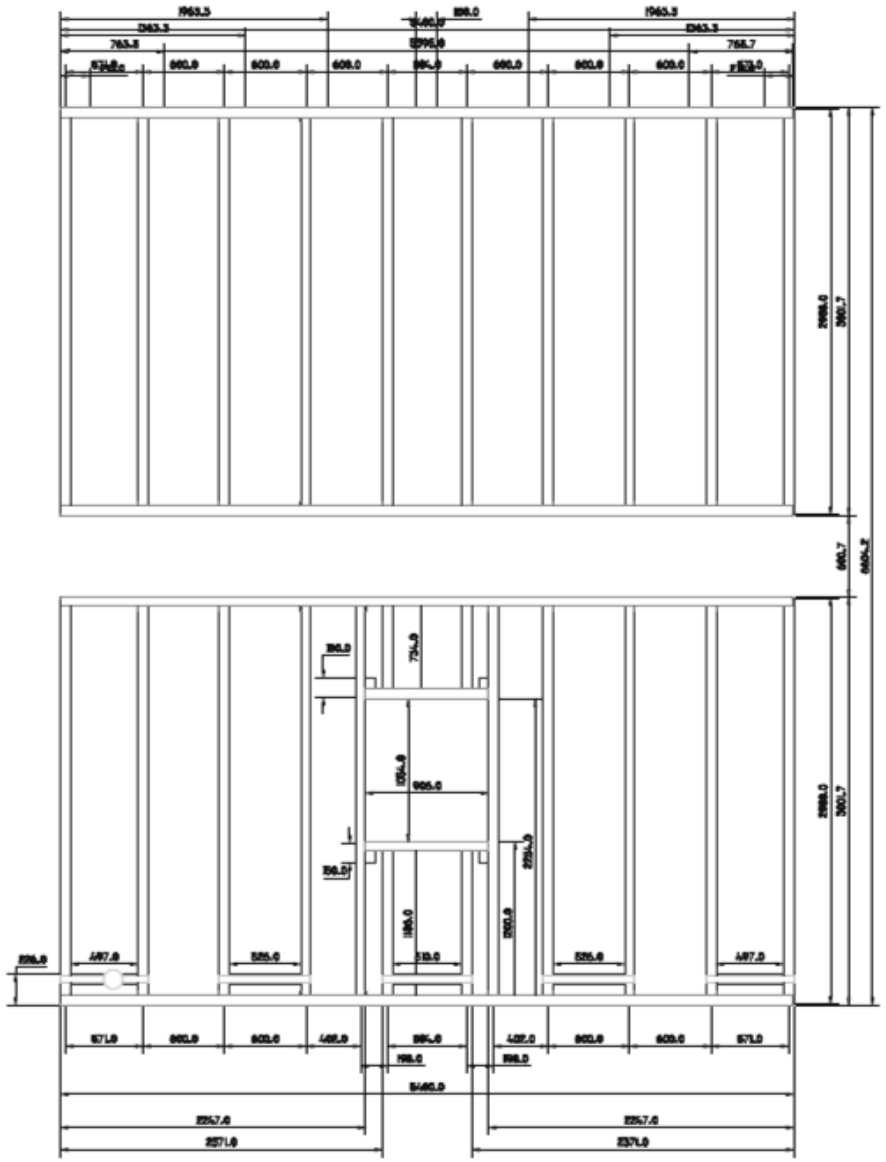

97, 98, 99, 100
Chelsea Smoked Red
(Stretcher Slip: 215mm – 65mm – 42mm)
57, 58, 59, 60
Chelsea Smoked Red
(Stretcher Slip: 215mm – 65mm – 42mm)
101, 102, 103, 104
Chelsea Smoked Red
(Stretcher Slip: 215mm – 65mm – 42mm)
62, 63, 64, 65
Dark Multi Smooth
(Stretcher Slip: 215mm – 65mm – 64.5mm)
69, 70, 71, 72
Dark Multi Smooth
(Stretcher Slip: 215mm – 65mm – 64.5mm)
61, 66, 67, 68
Dark Multi Smooth
(Stretcher Slip: 215mm – 65mm – 64.5mm)
81, 82, 83, 84
Dark Multi Smooth
(Stretcher Slip: 215mm – 65mm – 42mm)
89, 90, 91, 92
Dark Multi Smooth
(Stretcher Slip: 215mm – 65mm – 42mm)
85, 86, 87, 88
Dark Multi Smooth
(Stretcher Slip: 215mm – 65mm – 42mm)

7. SYSTEM DRAWINGS

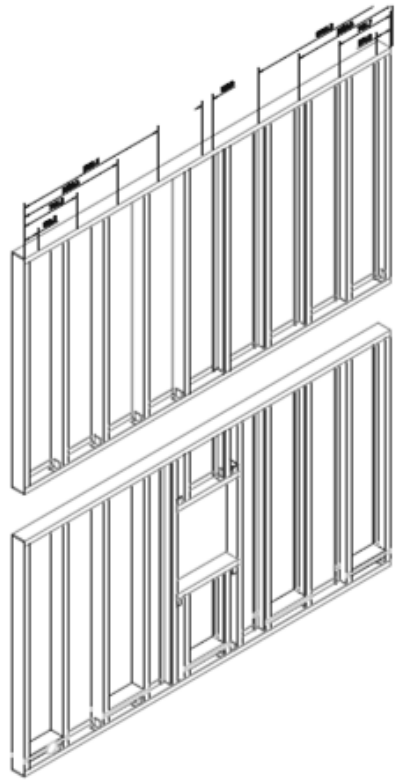




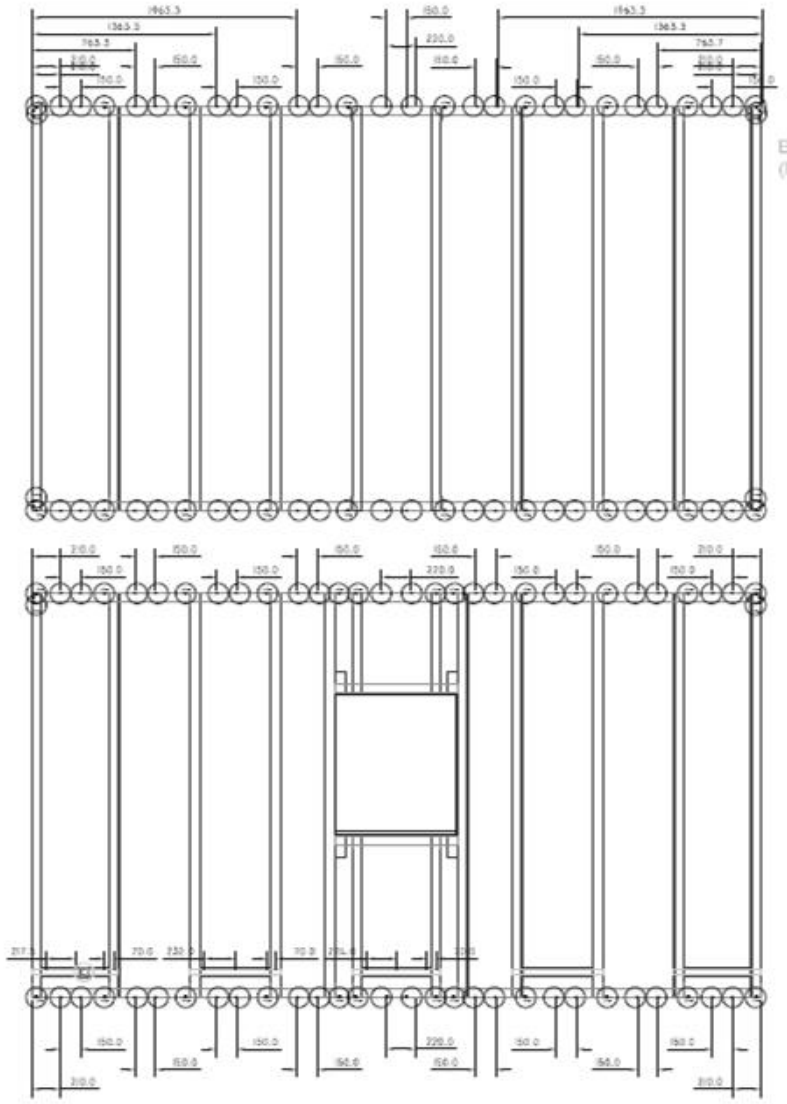
Sure Brick Rail Layout



Front Elevation -
Main Frame Layout

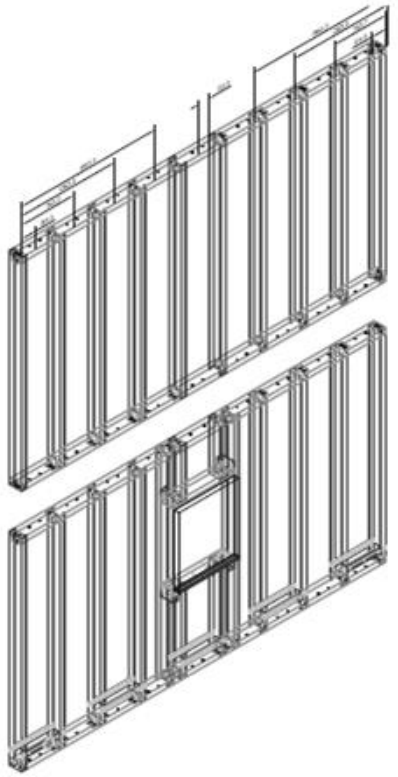


Isometric View -
Main Frame Layout

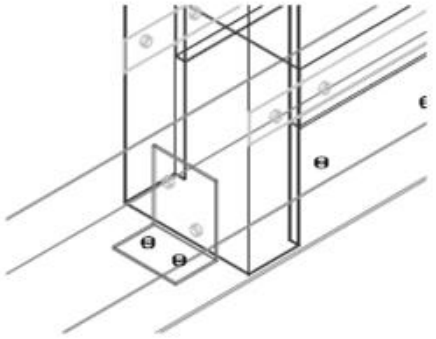


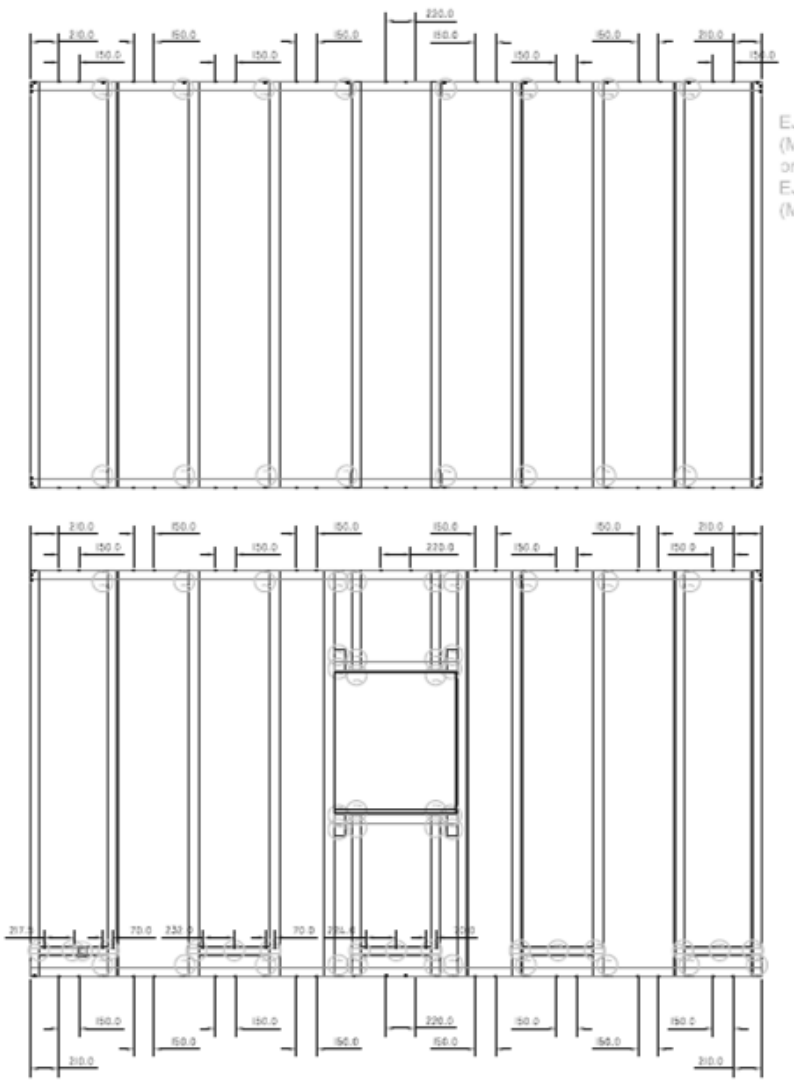
EJOT JT3-12-6,5 Fixings
(Metsec to Hot Rolled Steel)

Front Elevation -
Main Frame Fixing Layout



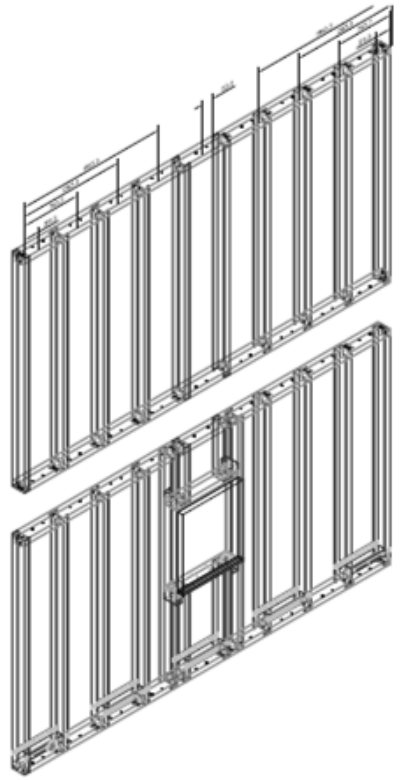
Isometric View -
Main Frame Layout



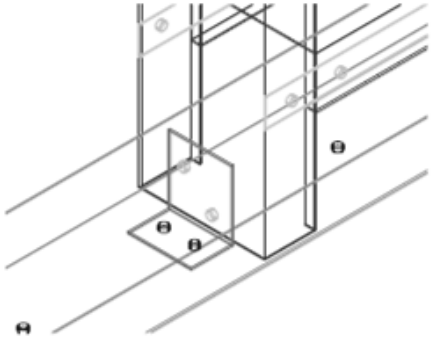


EJOT JT3-LT3-6,5 x 25mm Fixings
(Metsec to Metsec) pre-drilled bracket
or
EJOT JT3 FR 6 5,5 x 25mm
(Metsec to Metsec)

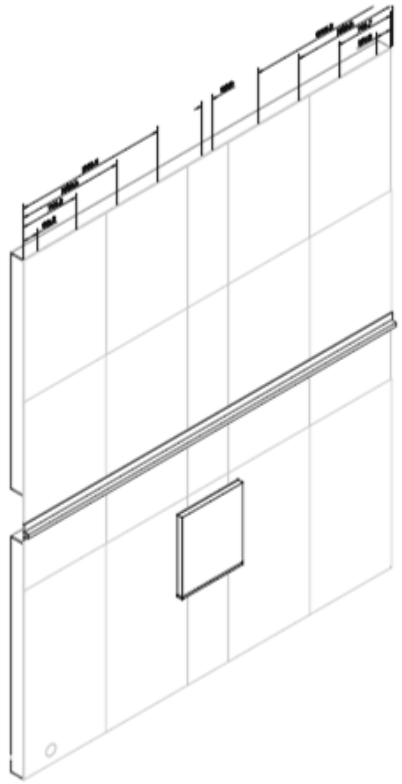
Front Elevation -
Main Frame Fixing Layout



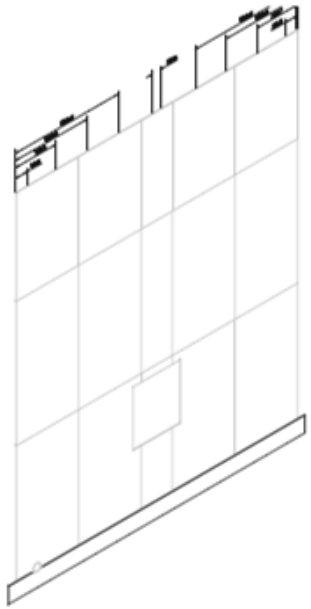
Isometric View -
Main Frame Layout

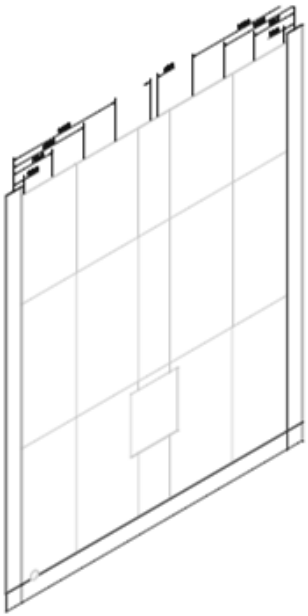


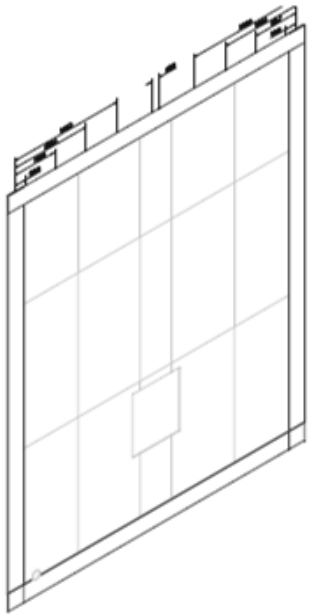
Front Elevation -
Main Frame Fixing Layout

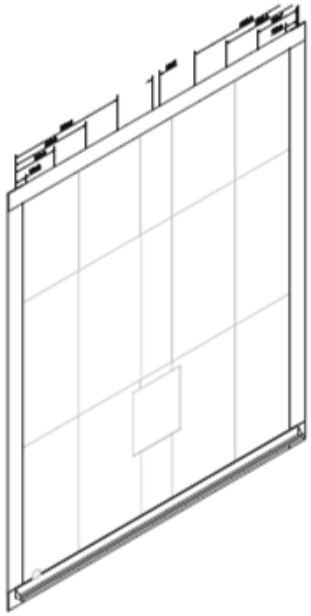


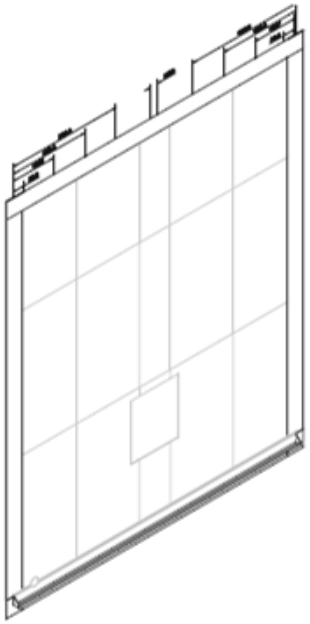
Isometric View -
Main Frame Layout

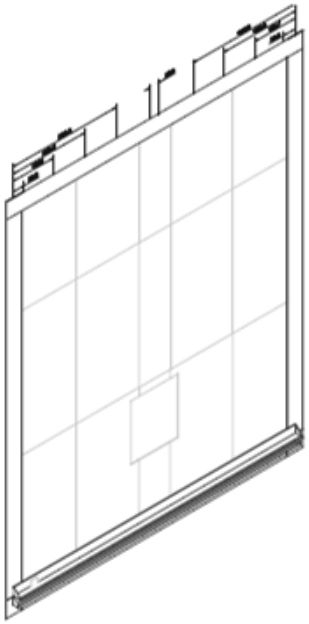


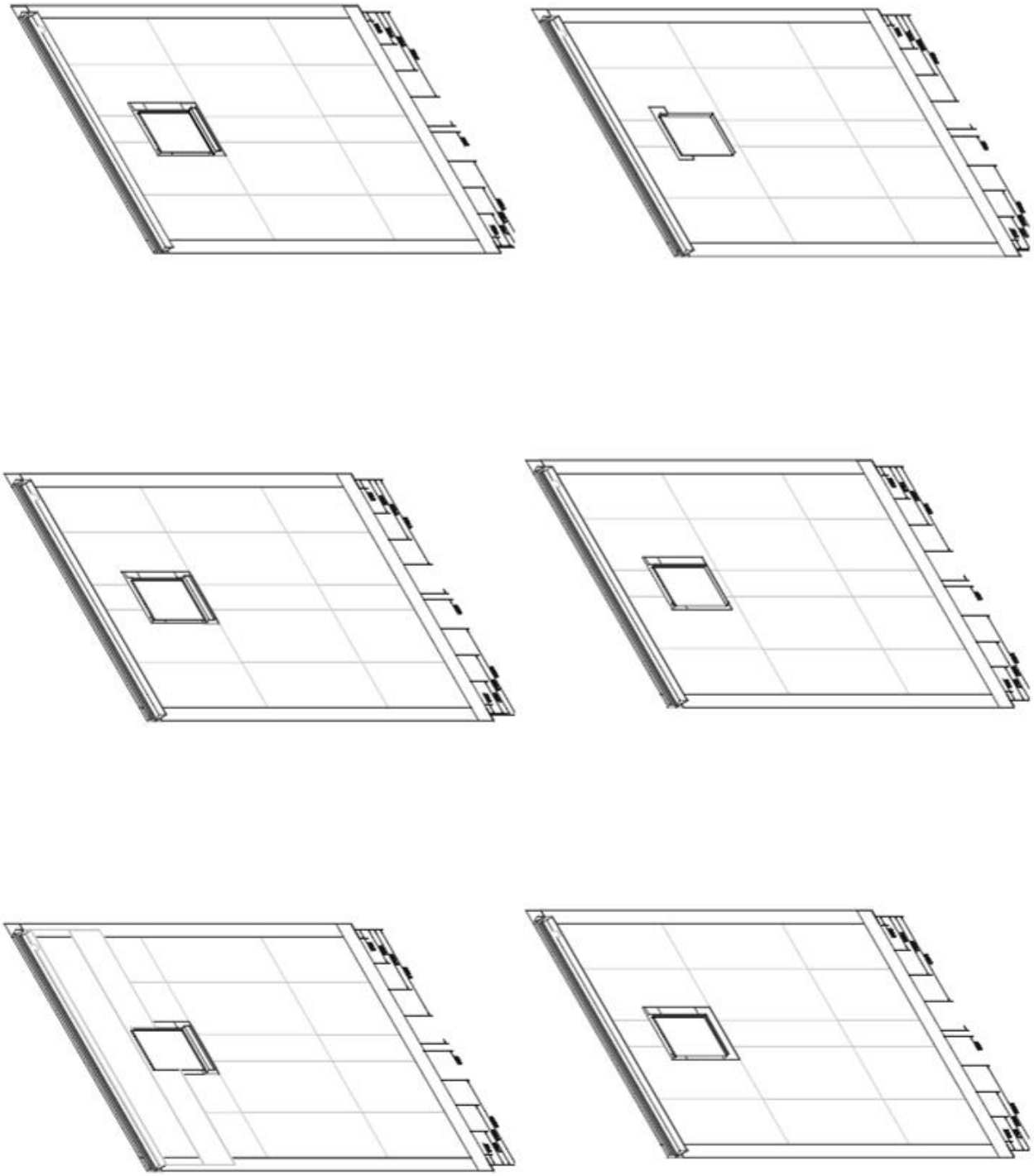


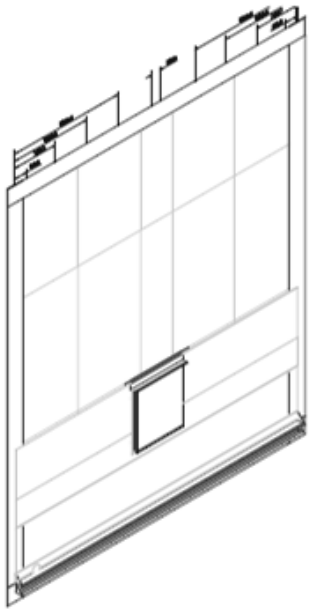


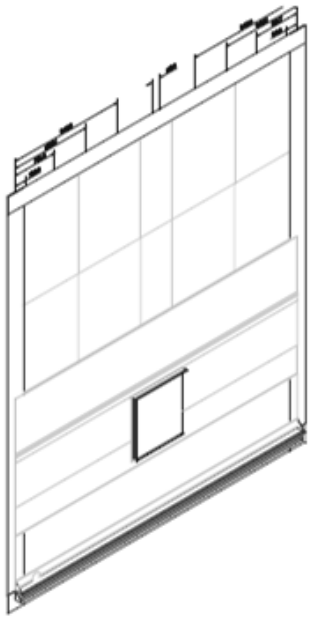


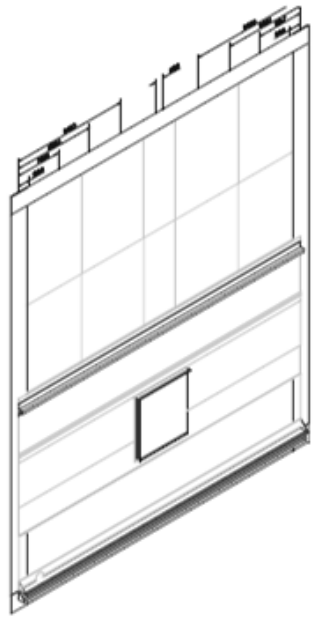


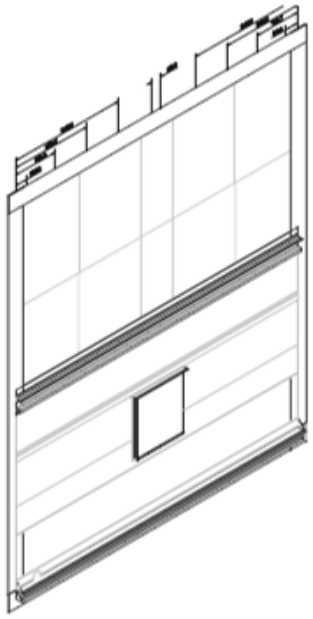


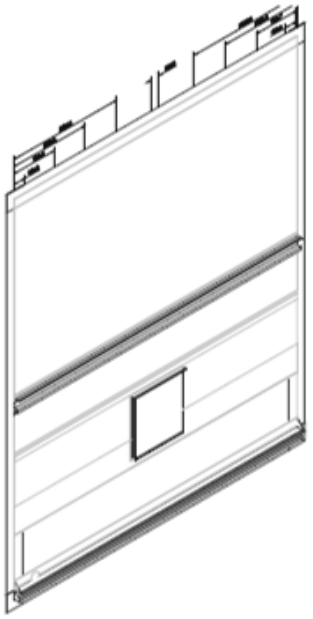




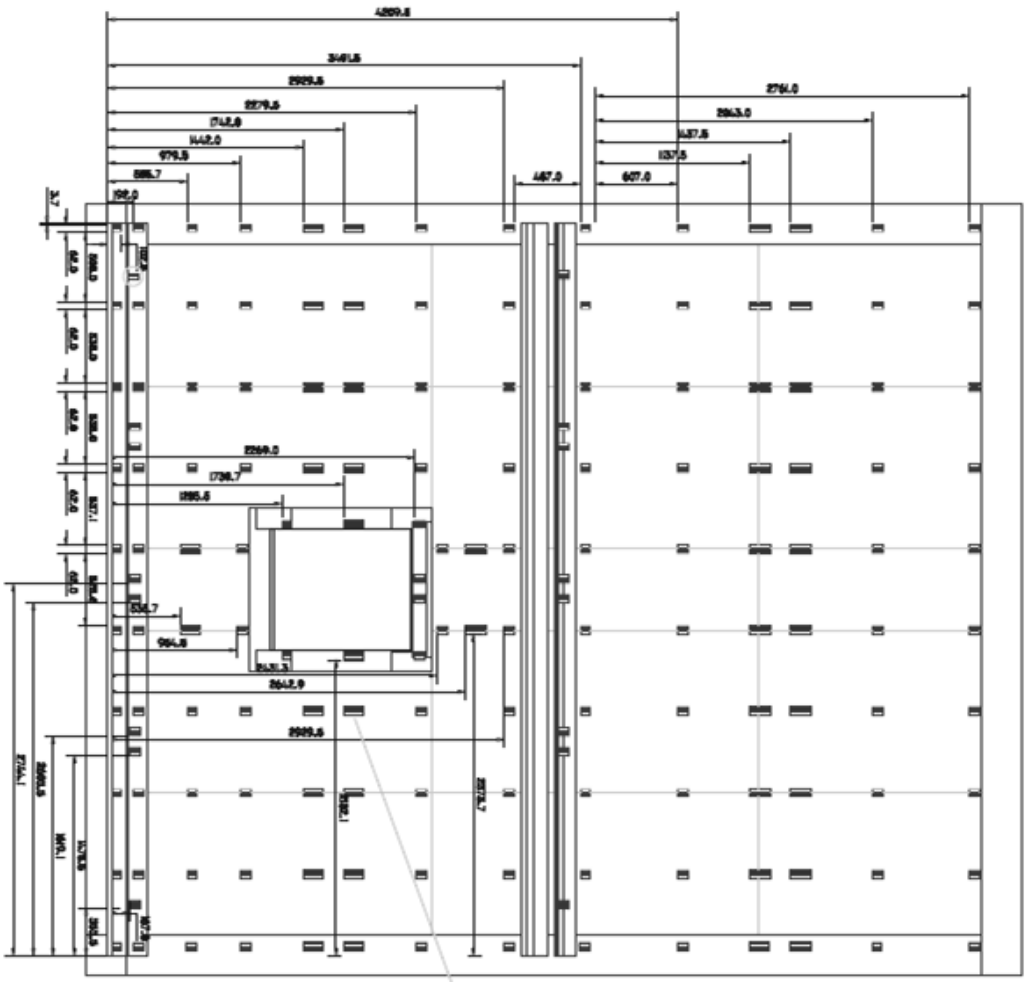






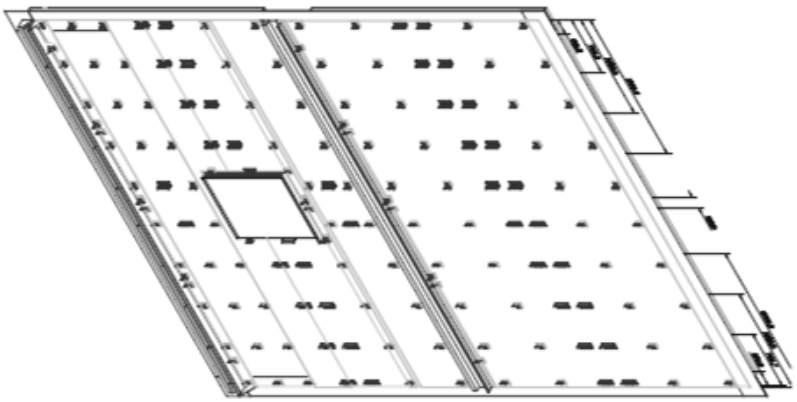


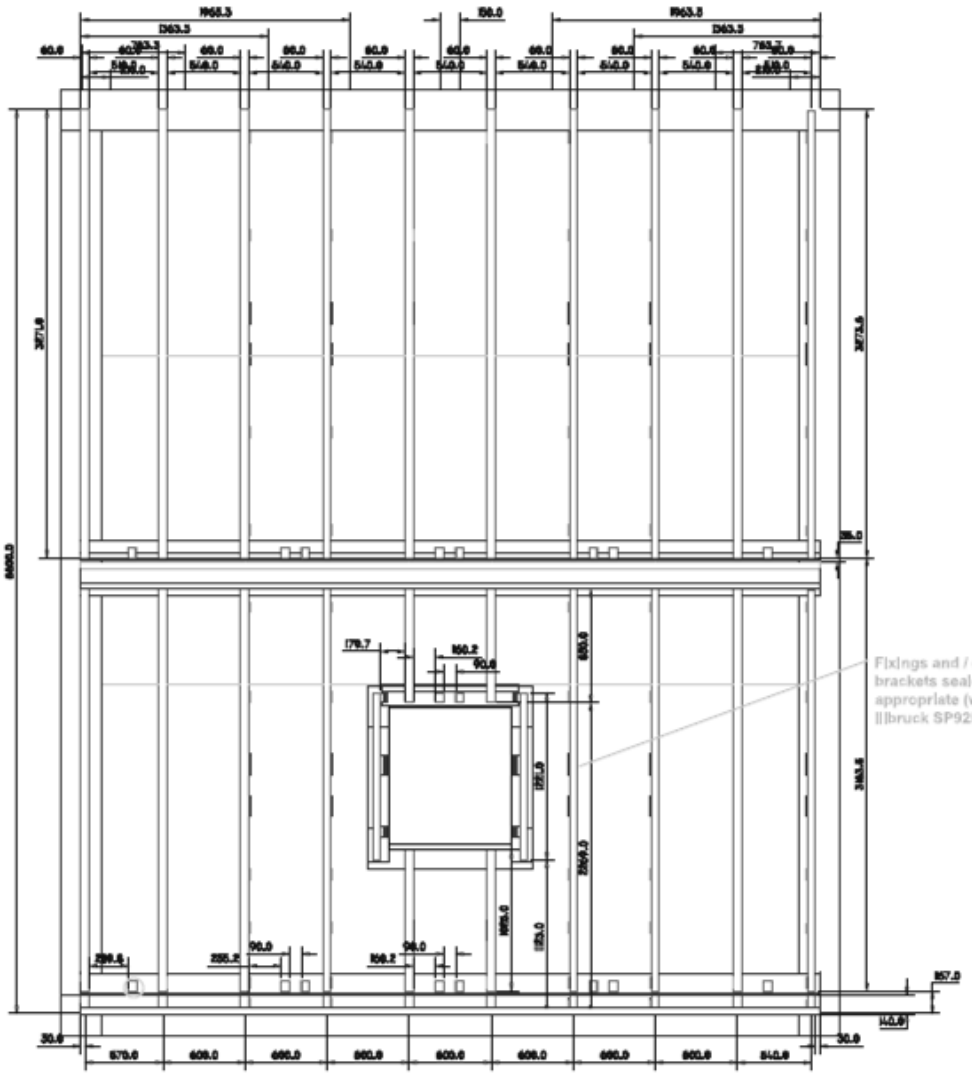
Front Elevation - Main Frame Layout



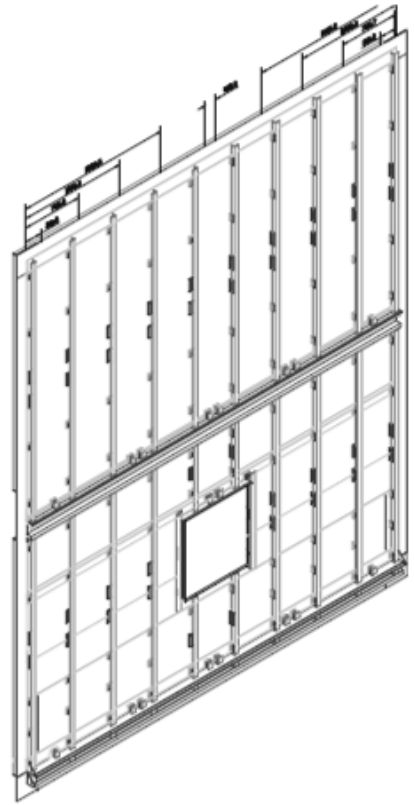
Fixings and / or brackets sealed were appropriate (with Illbruck SP925)

Isometric View - Main Frame Layout

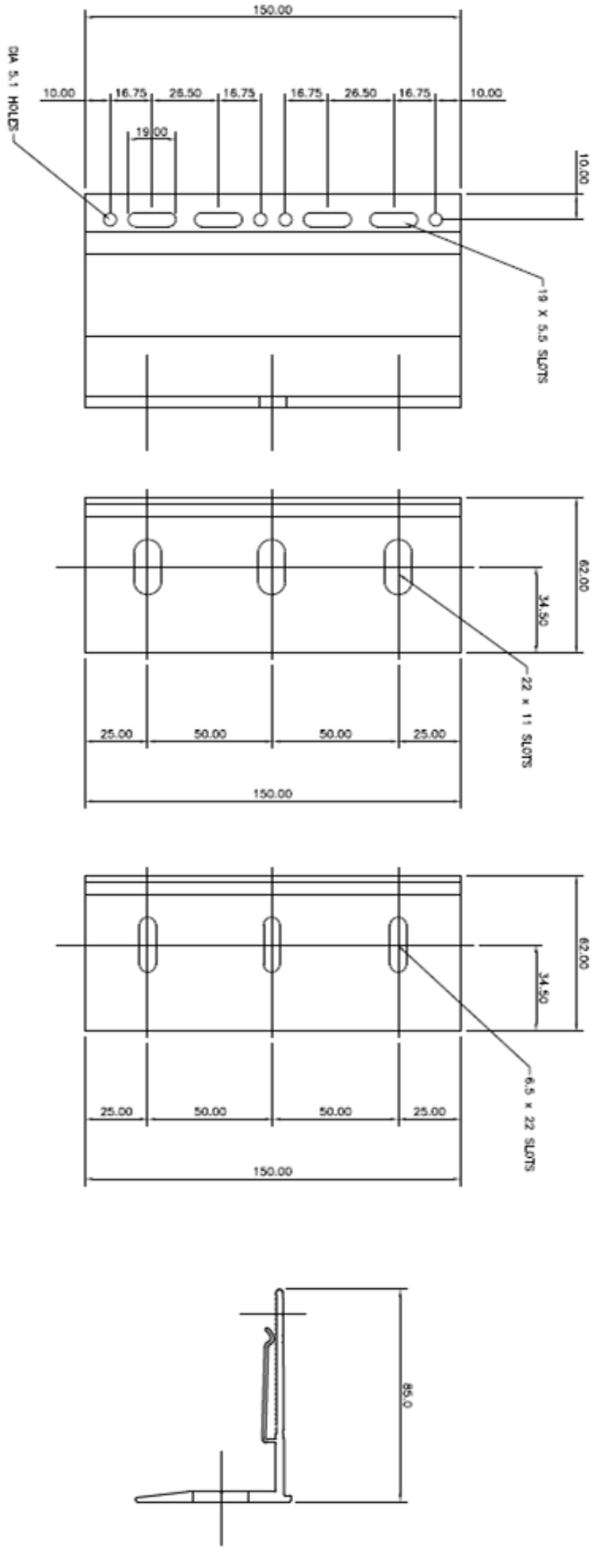


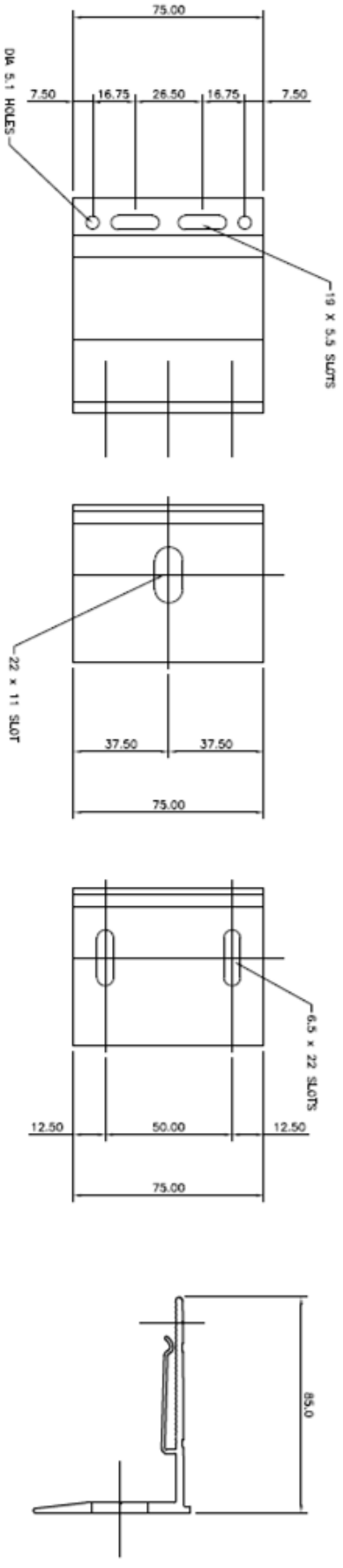


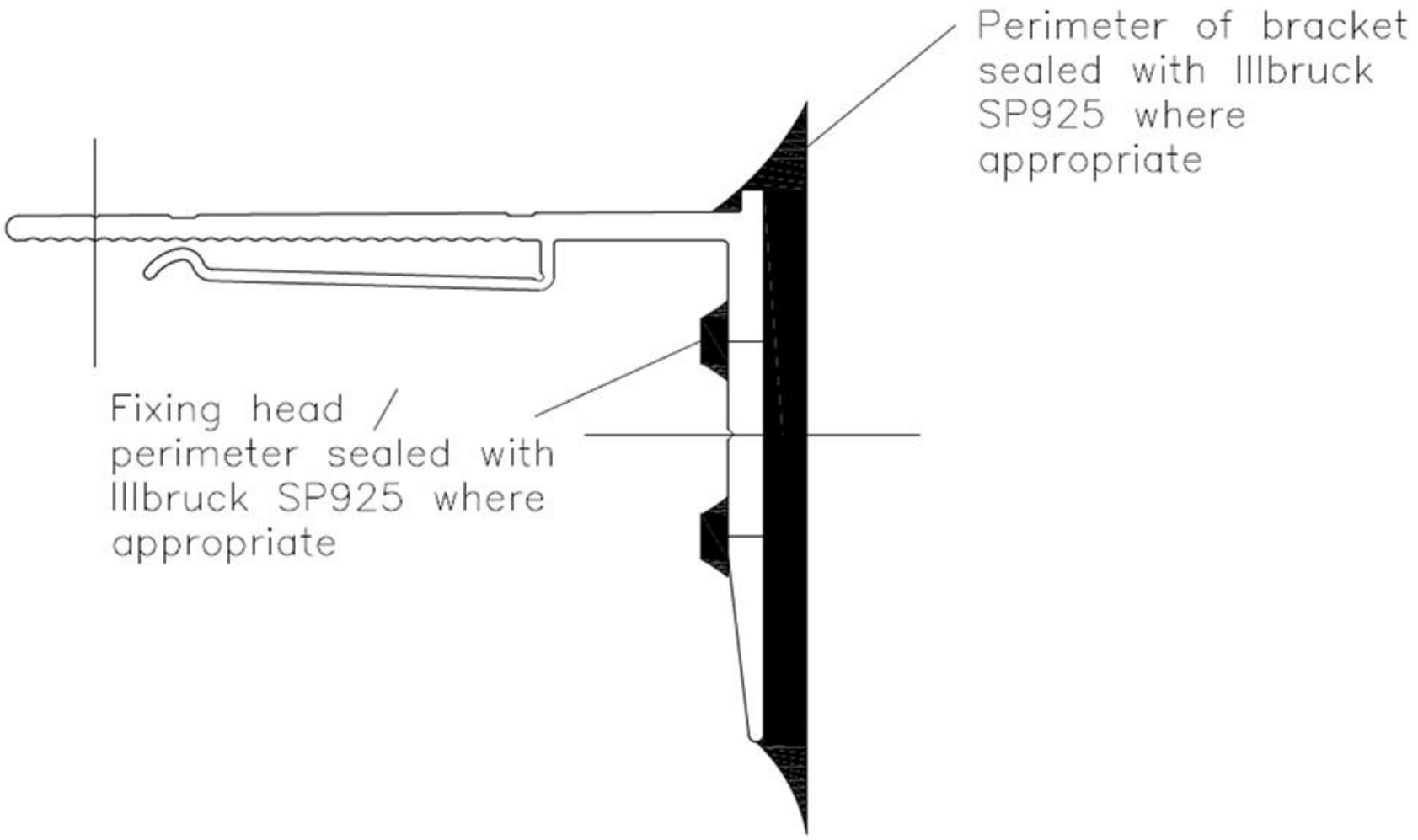
Front Elevation –
Main Frame Layout

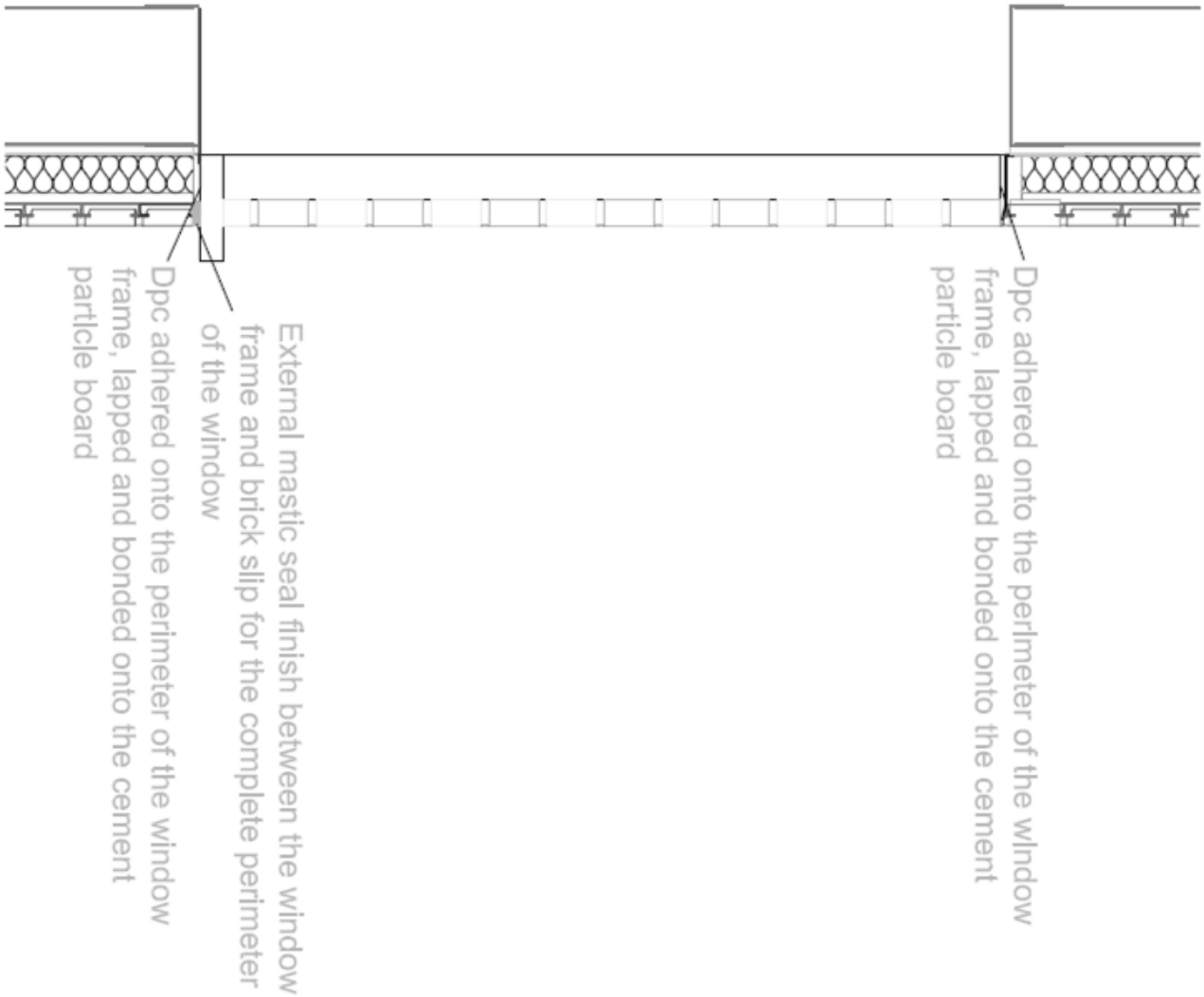


Isometric View –
Main Frame Layout


150.00
DIA 5.1 HOLES
10.00
16.75
26.50
16.75
16.75
26.50
16.75
10.00
19.00
10.00
19 X 5.5 SLOTS
62.00
34.50
22 x 11 SLOTS
25.00
50.00
50.00
25.00
150.00
62.00
34.50
6.5 x 22 SLOTS
25.00
50.00
50.00
25.00
150.00
85.0


75.00
DIA 5.1 HOLES
7.50
16.75
26.50
16.75
7.50
19 X 5.5 SLOTS
22 x 11 SLOT
37.50
37.50
75.00
6.5 x 22 SLOTS
12.50
50.00
12.50
75.00
85.0

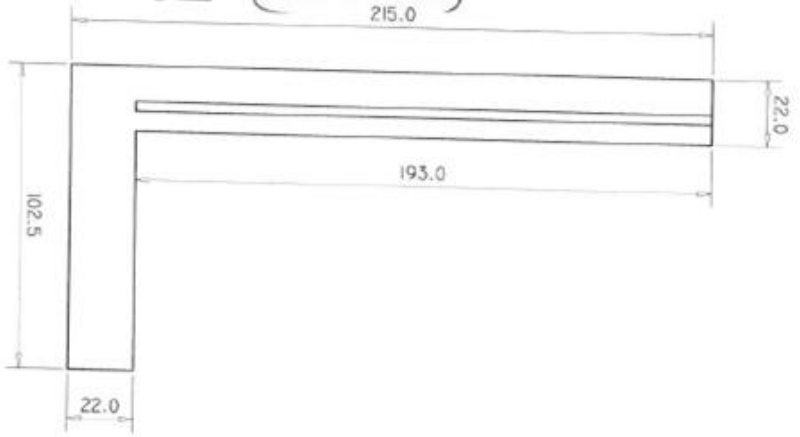

Perimeter of bracket sealed with Illbruck SP925 where appropriate
Fixing head / perimeter sealed with Illbruck SP925 where appropriate


Dpc adhered onto the perimeter of the window frame, lapped and bonded onto the cement particle board
External mastic seal finish between the window frame and brick slip for the complete perimeter of the window
Dpc adhered onto the perimeter of the window frame, lapped and bonded onto the cement partlcle board

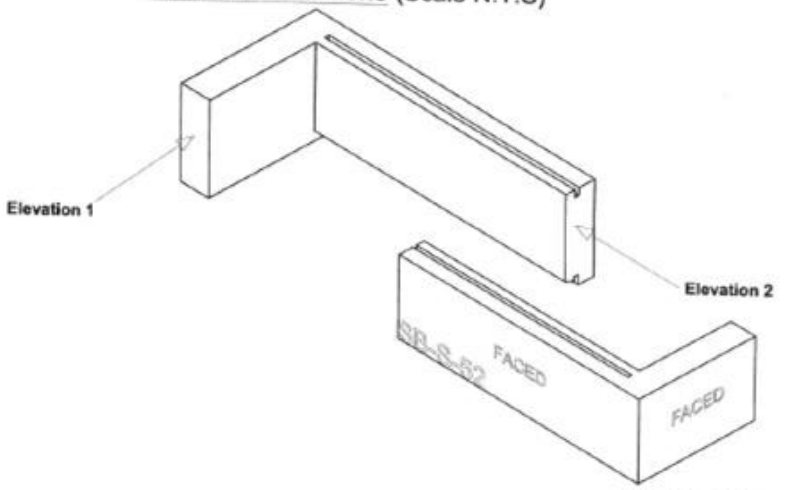
DARK MULTI SMOOTH

Profiling (Slip production drawing)

SB-P-52 (SMOOTH FACE)

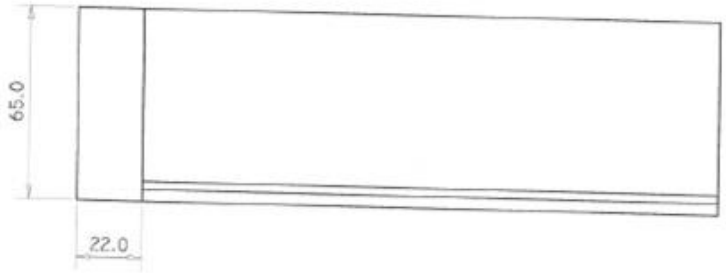


Isometric Elevations (Scale N.T.S)

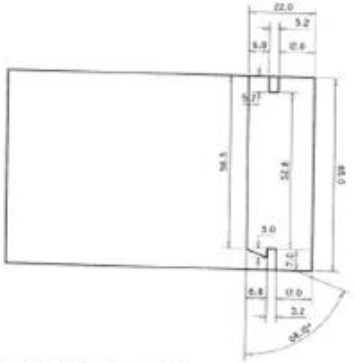


Right Handed Shown

Plan View (Scale 1:2)



Elevation 1 (Scale 1:2)



Elevation 2 (Scale 1:2)

FORTERRA

Technical: +44 (0) 330 123 1018
Email: adtechnical@forterra.co.uk
Web: www.forterra.co.uk

Project:	Customer:	Drawing Title:	Drawing No.
Sure Brick	Forterra Building Products Ltd	SB-P-52 Jamb 90 Degree Return (RH) - 215mm x 102.5mm - 22mm	SB-P-52

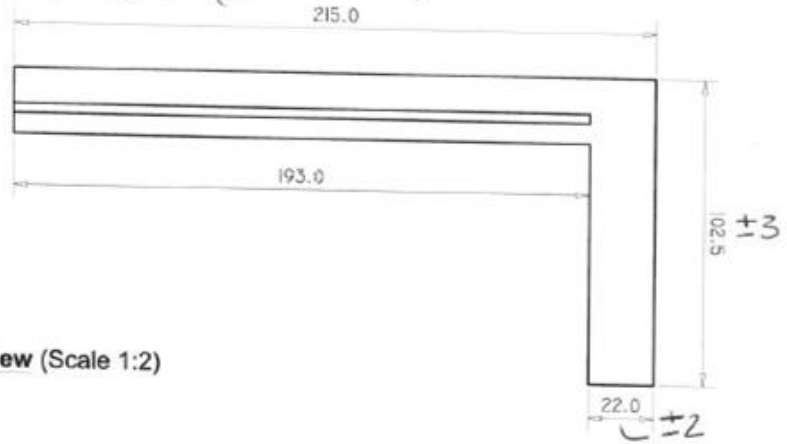
Date: 17/12/18
Drawn: MH
Scale: Specified on DWG
Revision

It is the contractors sole responsibility to ensure that all design detailing shown above comply with the relevant requirements from the Building Regulations, British Standards and Codes of Practice. It is the contractors sole responsibility to check that all specifications and quantities are correct prior to placement of order and any commencement of works onsite - all discrepancies should be reported immediately to Forterra. Do not scale from this drawing.

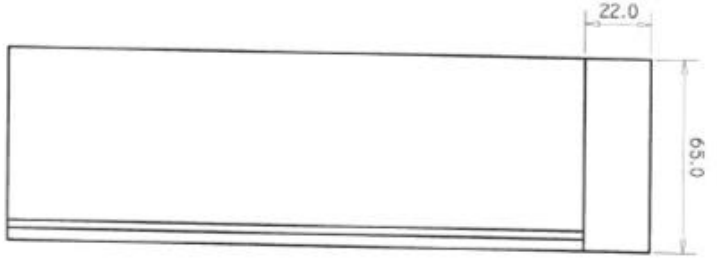
DARK MULTI SMOOTH.

Profiling (Slip production drawing)

SB-P-51 (GROUND FLOOR)

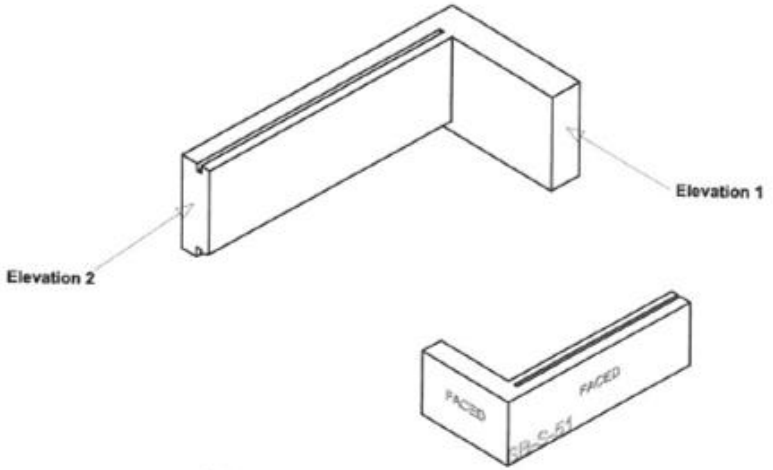


Plan View (Scale 1:2)

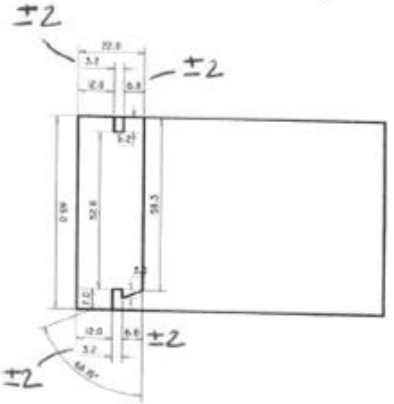


Elevation 1 (Scale 1:2)

Isometric Elevations (Scale N.T.S)



Left Handed Shown



Elevation 2 (Scale 1:2)

FORTERRA

Technical: +44 (0) 330 123 1016
Email: ukttechnical@forterra.co.uk
Web: www.forterra.co.uk

Project:	Customer:	Drawing Title:	Drawing No.	
Sure Brick	Forterra Building Products Ltd	SB-P-51 Jamb 90 Degree Return (LH) - 215mm x 102.5mm - 22mm	SB-P-51	Date: 17/12/18 Drawn: MH Scale: Specified on DWG

Revision

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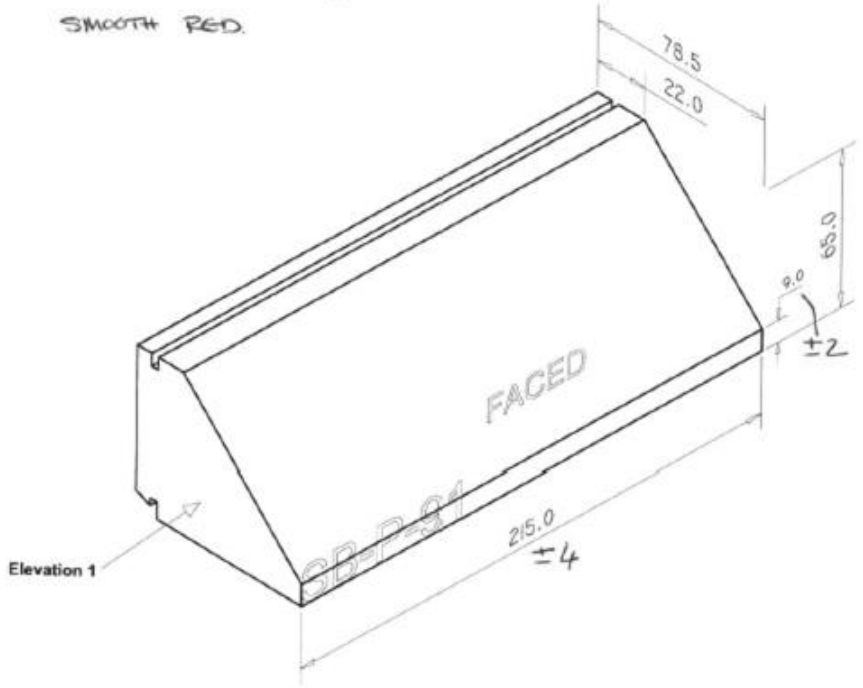
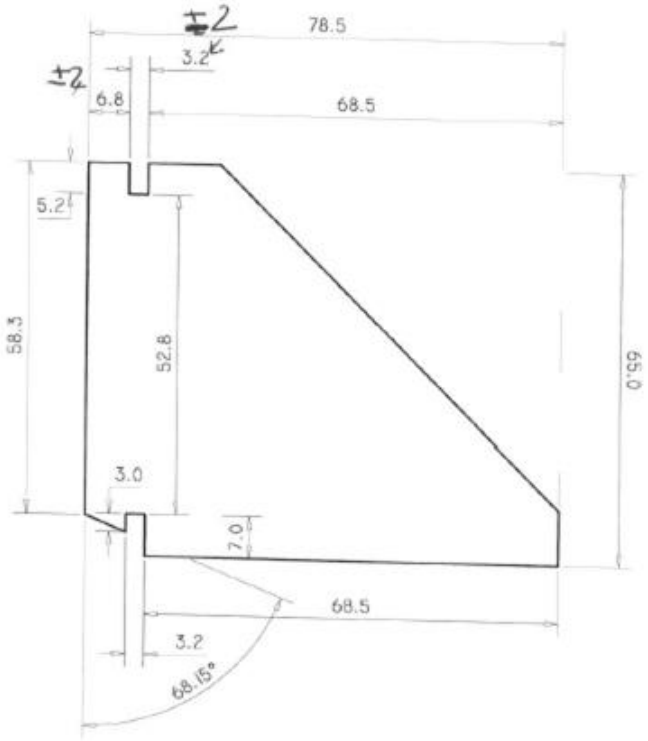
Profiling (Slip production drawing)

SB-P-91 (GROUND FLOOR)

SMOOTH RED.



Elevation 1



Isometric View (Scale 1:2)

Elevation 1 (Scale 1:1)

FORTERRA

Technical: +44 (0) 330 123 1016
Email: ukitechnical@forterra.co.uk
Web: www.forterra.co.uk

Project: Sure Brick	Customer: Forterra Building Products Ltd	Drawing Title: SB-P-91 PL3.1 Plinth Stretcher - 215mm - 65mm - 78.5mm	Drawing No. SB-S-91	Date: 17/11/18
			Revision	Drawn: MH
				Scale: Specified On DWG

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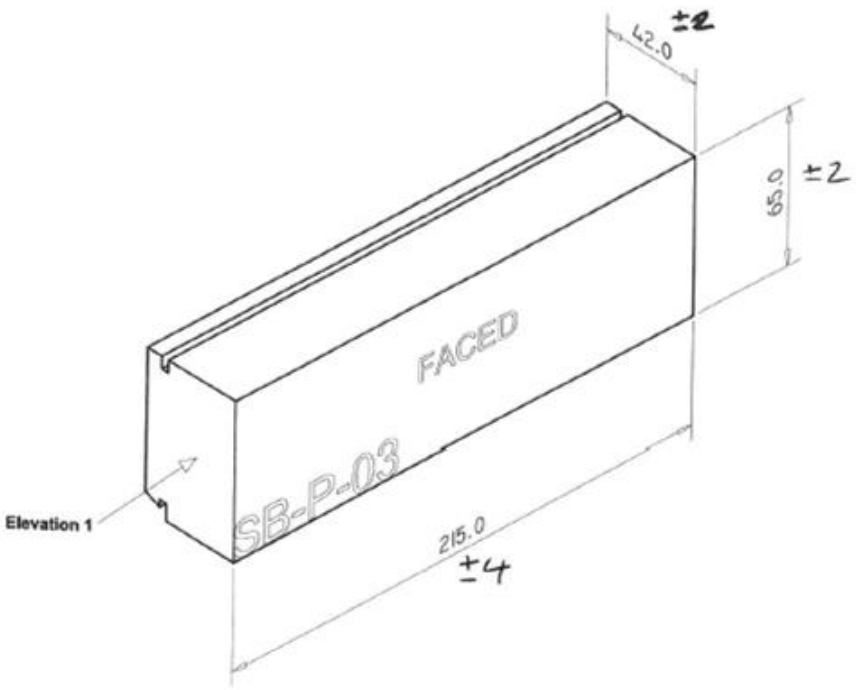
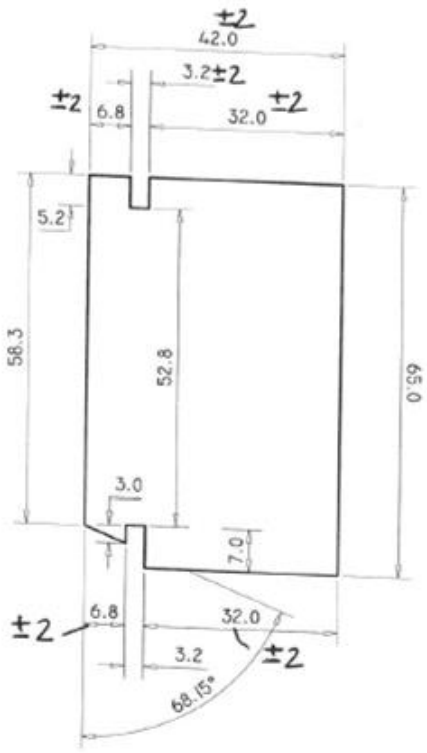
Profiling (Slip production drawing)

SB-P-03 (Cut from Faced Solid) CHELSEA SMOOTH RED (FIRST FLOOR)





Isometric View (Scale 1:2)

Elevation 1 (Scale 1:1)

FORTERRA

Technical.. +44 (0) 330 123 1016
Email.. sbktechnical@forterra.co.uk
Web.. www.forterra.co.uk

Project : Sure Brick

Customer : Forterra Building Products Ltd

Drawing Title : SB-P-03
Stretcher Slip - 215mm - 65mm - 42mm

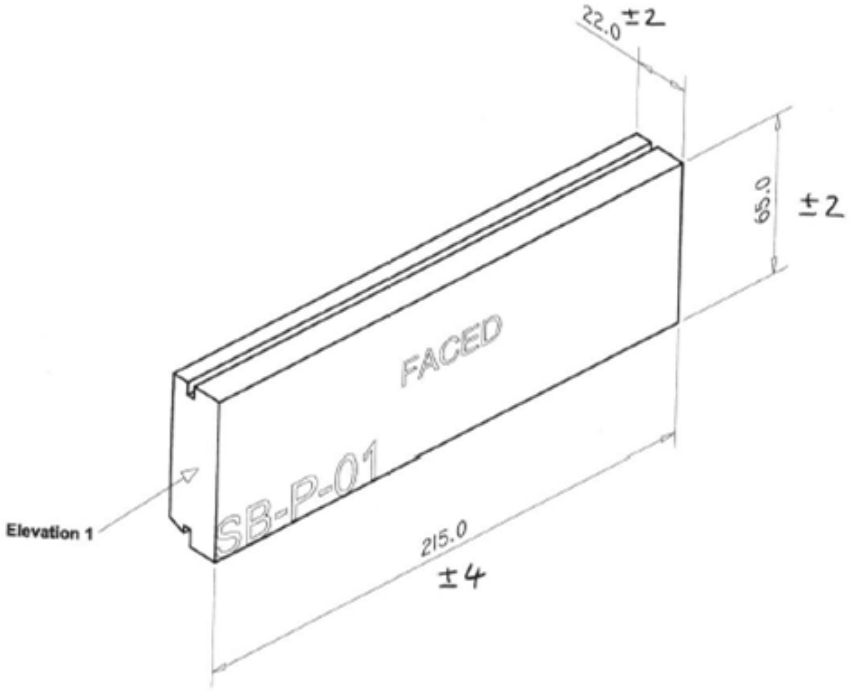
Drawing No. SB-P-03

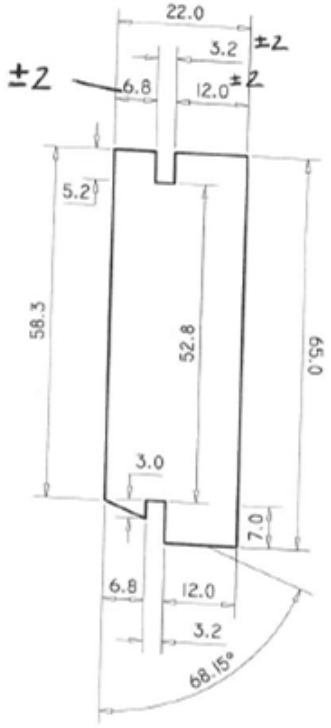
Date : 07/01/2019
Drawn : MH
Scale : Specified On DWG

It is the contractors sole responsibility to ensure that all design detailing shown above comply with the relevant requirements from the Building Regulations, British Standards and Codes of Practice. It is the contractors sole responsibility

Profiling (Slip production drawing)

SB-P-01 CHELSEA SMOOTH RED (FIRST FLOOR)





Isometric View (Scale 1:2)

Elevation 1 (Scale 1:1)

FORTERRA

Technical: +44 (0) 330 123 1016
Email: sbtechnical@forterra.co.uk
Web: www.forterra.co.uk

Project : Sure Brick

Customer : Forterra Building Products Ltd

Drawing Title : SB-P-01
Stretcher Slip - 215mm - 65mm - 22mm

Drawing No. SB-P-01

Revision

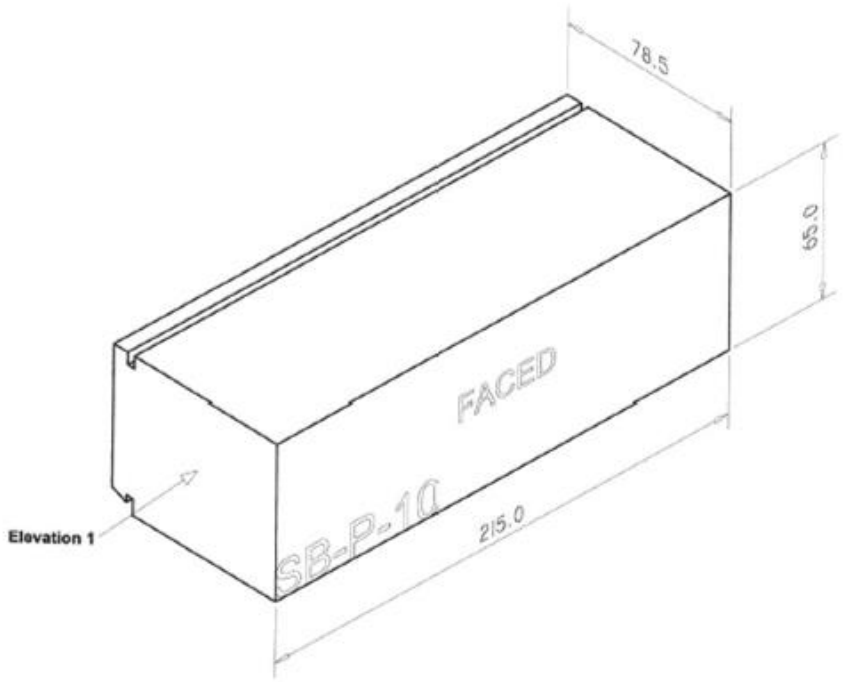
Date : 07/01/2019
Drawn : MH
Scale : Specified on DWG

It is the contractors sole responsibility to ensure that all design detailing shown above comply with the relevant requirements from the Building Regulations, British Standards and Codes of Practice. It is the contractors sole responsibility to check that all specifications and quantities are correct prior to placement of order and any commencement of works onsite - all inaccuracies must be reported immediately to Forterra. Do not scale from this drawing.

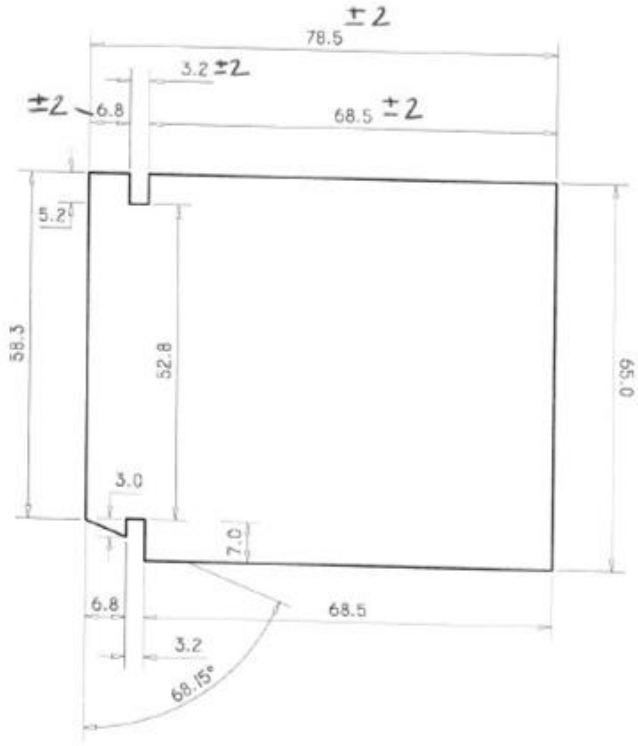
Profiling (Slip production drawing)

SB-P-10 (Cut from Faced Solid) (GROUND FLOOR)

DARK MULTI SMOOTH



Isometric View (Scale 1:2)



Elevation 1 (Scale 1:1)

FORTERRA

Technical: +44 (0) 330 123 1018
Email: sales.technical@forterra.co.uk
Web: www.forterra.co.uk

Project: Sure Brick	Customer: Forterra Building Products Ltd	Drawing Title: SB-P-10 Stretcher Slip - 215mm - 65mm - 64.5mm	Drawing No. SB-P-10	Date: 07/01/2019
			Revision	Drawn: MH
				Scale: Specified On DWG

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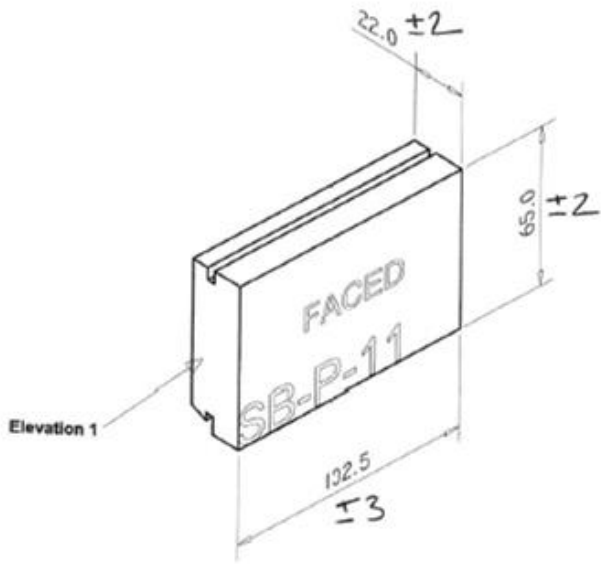
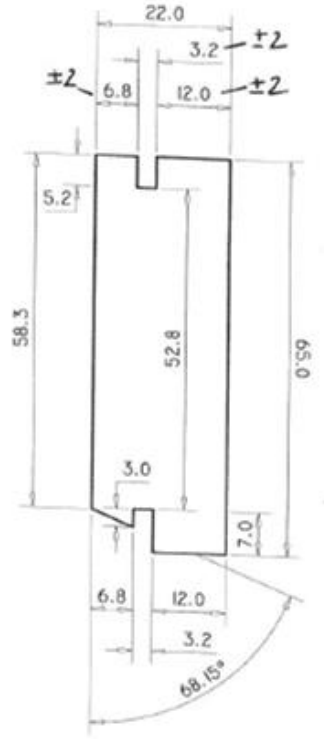
Profiling (Slip production drawing) CHELSEA SMOOTH RED (FIRST FIXER)

SB-P-11





Isometric View (Scale 1:2)

Elevation 1 (Scale 1:1)

FORTERRA

Tech/dial. +44 (0) 330 123 1018
Email. adktechnical@forterra.co.uk
Web. www.forterra.co.uk

Project : Sure Brick

Customer : Forterra Building Products Ltd

Drawing Title : SB-P-11
Header Slip - 102.5mm - 65mm - 22mm

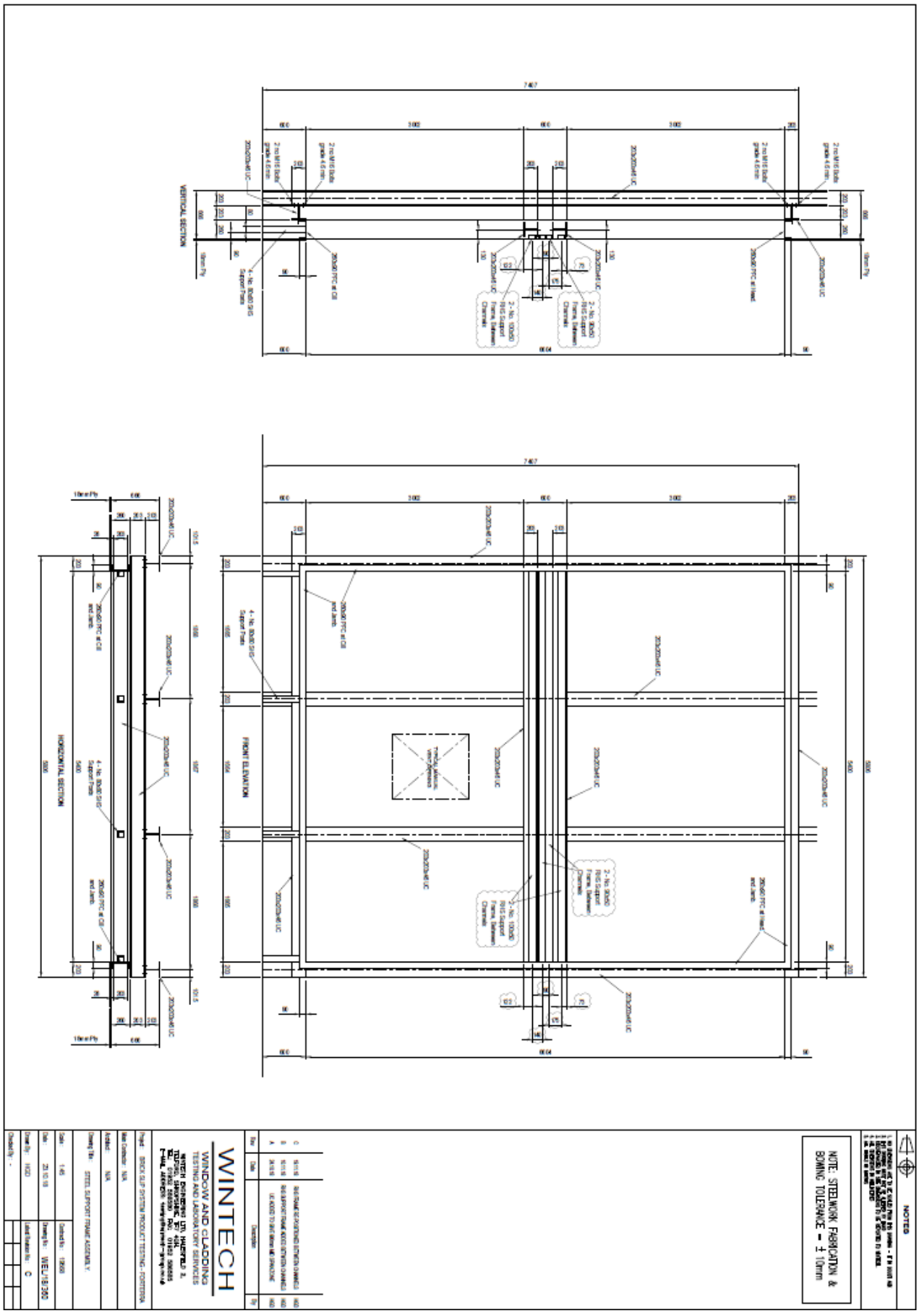
Drawing No. SB-P-11

Revision

Date : 07/01/2019
Drawn : MH
Scale : Specified On DWG

It is the contractors sole responsibility to ensure that all design detailing shown above comply with the relevant requirements from the Building Regulations, British Standards and Codes of Practice. It is the contractors sole responsibility to check that all specifications and quantities are correct prior to placement of order and any commencement of works onsite - all discrepancies must be reported immediately to Forterra.

8. STEEL SUPPORT DRAWING



9. DISMANTLING

The dismantling was conducted on 8th and 9th of April 2019 by representatives of Forterra Building Products Limited and was witnessed by representatives of Wintech Engineering Ltd.

There was no water evident in the system in parts designed not to be wetted, and it was found that the system fully complied with the system drawings in Section 8 provided by Forterra Building Products Limited at the time of the dismantle.

Photograph No. 3

Sample prior to the dismantle.

Photograph No. 4

'Sure Brick' Rail layout with brick slip removed.

Photograph No. 5

Window interface with brick slip removed.

Photograph No. 6

Brick slip (stretcher slip profile) between support rail.

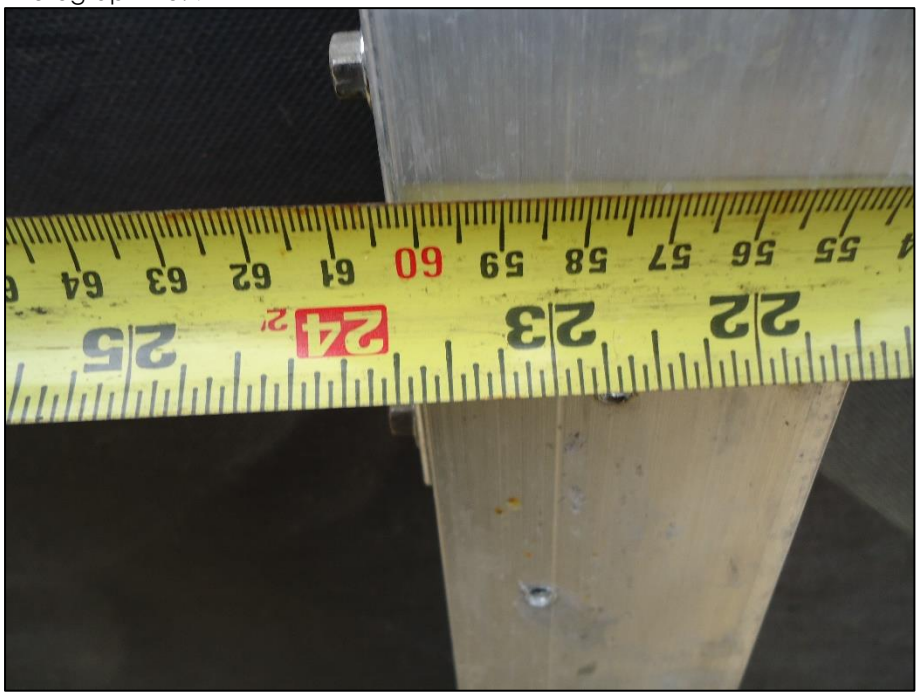
Photograph No. 7

Soldier support rail layout

Photograph No. 8

Front elevation showing vertical support rails and weatherproofing.

Photograph No. 9



Mid vertical rail span measured (600 mm).

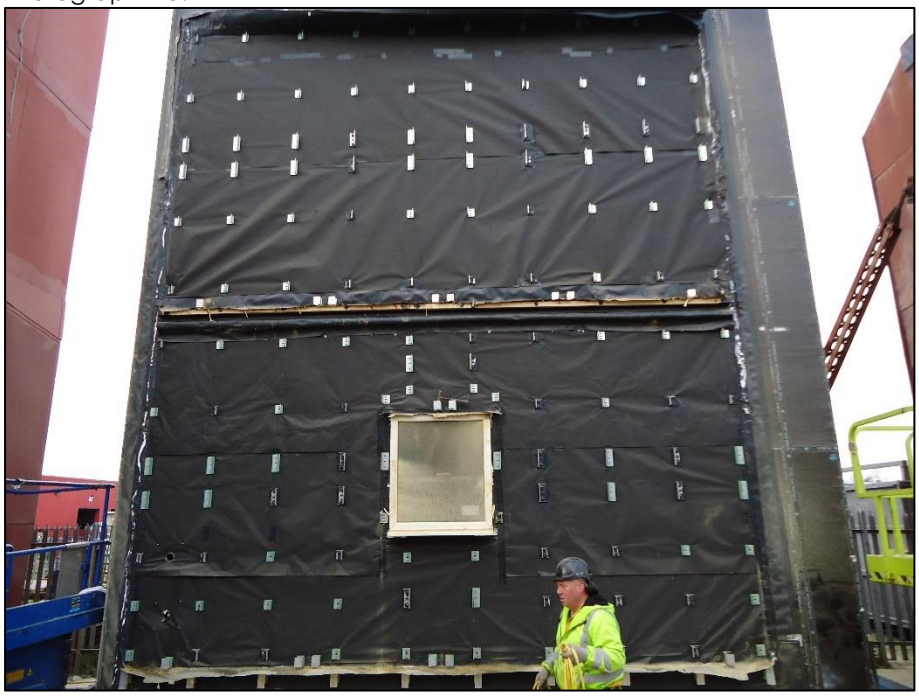
Photograph No. 10

Helping hand bracket connection to vertical rail.

Photograph No. 11

Helping hand bracket and fixings sealed.

Photograph No. 12



Helping hand brackets with vertical rails removed.

Photograph No. 13

Cement boards.

Photograph No. 14

Window interface to cement board.

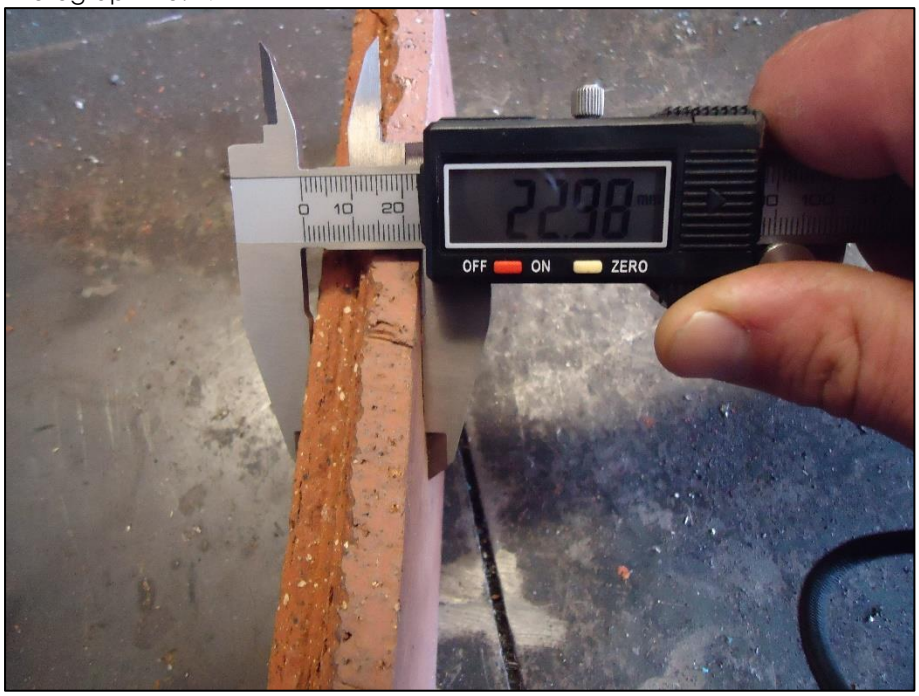
Photograph No. 15

Internal – Window fixing bracket to SFS.

Photograph No. 16

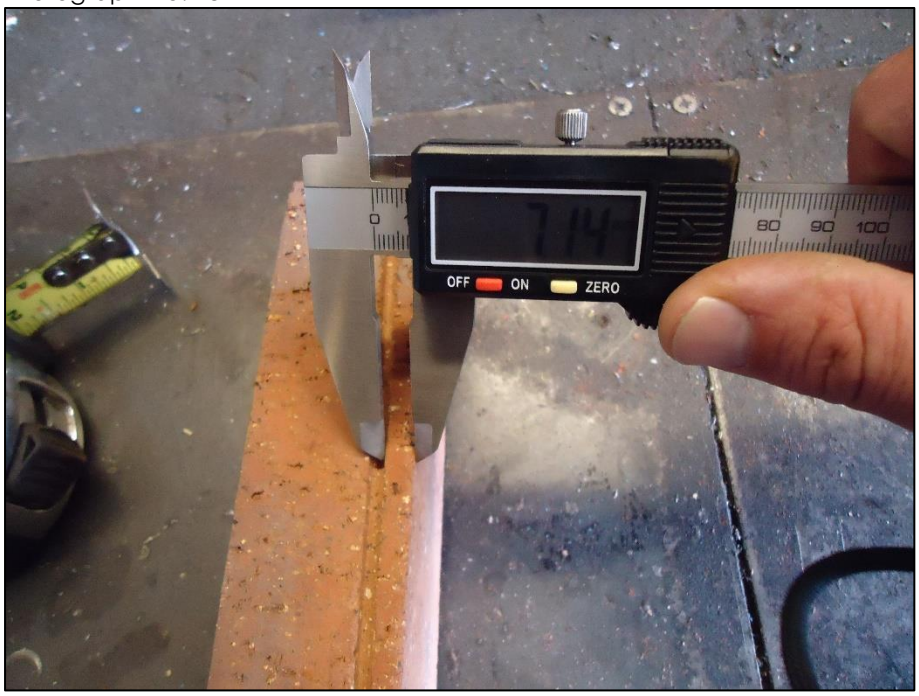
Steel frame support system.

Photograph No. 17



'Stretcher Slip' brick profile, depth.

Photograph No. 18



'Stretcher Slip' brick profile.

10. Amendments

Revision No.	Amendments	Date of Amendments
1	1. Abbreviation of 'Ltd' changed to 'Limited' in all references to Forterra Building Products Limited. 2. Updated list of test witnesses. 3. Updated product description. 4. Added TN 76 impact category table to 'Test Procedures' and classification tables to 'Test Results'	03.06.19

---------- END OF REPORT ----------